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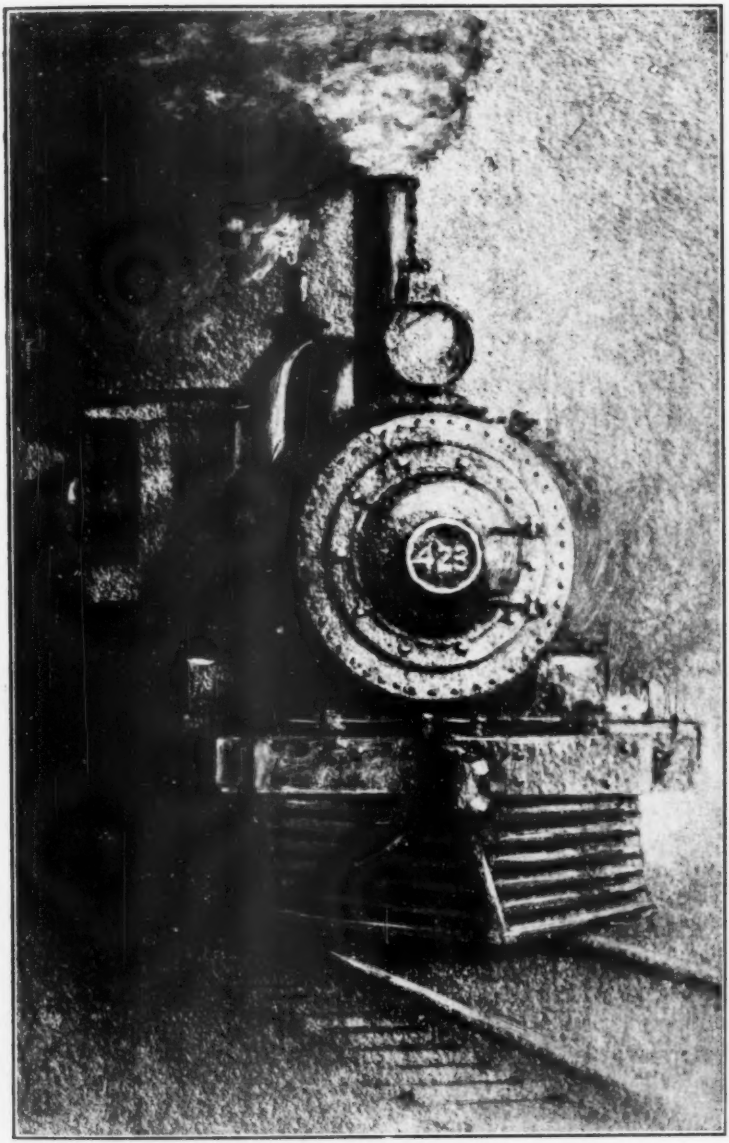
Bulletin No. 25



The Railway and Locomotive Historical Society

Monument Erected by the Men and Women of the Southern Pacific Company
— to —
THEODORE DeHONE JUDAH

—Courtesy S. P. News Bureau.

BULLETIN No. 25

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IN presenting this bulletin to our members, we are calling your attention that it is the first bulletin containing the miscellaneous articles to be issued this year. We are very glad to be able to reproduce the contribution on Grand Trunk motive power which was promised for BULLETIN No. 23. Mr. Loye has given us a very interesting account of the old locomotives on that road and the illustrations that have accompanied this article we are sure our readers will be interested in. The cover sketch was furnished by Mr. Loye and represents one of the Grand Trunk locomotives on the Ottawa Express about 1905.

One of our members, always alert for interesting material to be used in our bulletins, presents the thesis on a locomotive, written by Mr. Thomas Appleton, brother of Mr. F. E. Appleton, when the former was a student in college. It is a most interesting description of a locomotive built in 1867 and we are glad to reproduce it for the benefit of our members.

We wish to call the attention of our members to the collection of negatives which the Society has secured and which are listed in this bulletin. Possibly some of our members have duplicate negatives that they would be willing to donate to this Society of both modern and old locomotives to be used for this purpose.

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Theodore Dehone Judah

ON February 25, 1931, a monument erected to the memory of Theodore D. Judah was unveiled at Sacramento, California, having been dedicated on April 26, 1930.

Through the kindness of Mr. D. L. Joslyn, our Resident Western Director, we have been permitted to reproduce one of the pictures taken by Mr. Joslyn and we have used it as our frontispiece.

The granite stones were brought from the summit of the Sierra Mountains and the main stone weighed 45 tons before it was carved. The bust was cast in the Sacramento Shops of the Southern Pacific Co. and took one month to mold. The monument stands in the plaza of the Southern Pacific Station at Sacramento and was erected by the employees of the Southern Pacific Company.

Although the group standing before the monument hides the inscription, yet this group is of unusual interest. At the extreme left stands Mr. Charles H. Lewis, 89 years old, who is one of the remaining members of the gang that laid ten miles of track in one day. Mr. Lewis lives at Vallejo, Cal. Next comes Mr. Joseph M. Graham, also 89 years of age, of Berkeley, Cal., sole survivor of the Civil Engineers who built the Central Pacific R. R. Beside him stands Miss Janice Judah, of Santa Cruz, great-great grandniece of T. D. Judah, who unveiled the monument. Mr. Amos L. Bowsher, 92 years old stands beside her and he took part in the ceremony of driving the last spike at Promontory, Utah, in 1869. Mr. Bowsher lives at Sacramento. Next comes Mr. Joel O. Wilder, 80 years of age, of Sacramento and at the extreme right stands Mr. O. N. Cronkhite, 85 years old, of Berkeley, Cal. Both of these men served with the surveying parties as the line was built over the mountains.

The monument bears the following inscription:

"That the West may remember THEODORE DEHONE JUDAH, *pioneer civil engineer and tireless advocate of a great transcontinental railroad.*

"AMERICA'S FIRST".

"This monument was erected by the men and women of the Southern Pacific Company, who, in 1930, were carrying on the work he began in 1860. He convinced four Sacramento merchants that his plan was practicable and enlisted their help.

"Ground was broken for the railroad January 8th, 1863 at the foot of K Street nearby. Judah died November 2nd, 1863. The road was built past the site of this monument, over the lofty Sierras—along the line of JUDAH'S survey—to a junction with the Union Pacific at Promontory, Utah, where, on May 10th, 1869 'the last spike was driven' ".

Surely the "men and women" of the Southern Pacific Company should feel proud of this monument that they have erected to the "father" of the present Southern Pacific road.

The Hinkley Locomotive Works

By Chas. E. Fisher

HOLMES HINKLEY, the founder of the Hinkley Locomotive Works, was born in Hallowell, Maine, June 24, 1793. His father, Captain James Hinkley was lost in a storm in 1805. His mother, Mary Meigs lived to be eighty-five years old. He had two sisters and two brothers, all younger and all but one, Mary the next oldest, had died by 1807.

At about fourteen years of age, Holmes Hinkley was apprenticed to Ephraim Lord, of Hallowell, to learn the carpenters trade. After his apprenticeship, he spent one year at his trade in Hallowell and then decided to follow navigation. He was poorly educated but got some help from Captain Daniel Smith.

In July, 1815, he shipped on a little brig for the West Indies. This trip did not suit him and finding navigation dull, he returned home, packed his tools and came to Boston where he worked at his trade until the autumn of 1816. He then went to Washington where he continued to work at his trade until the autumn of 1819. His last job was on the Capitol of the United States.

In the fall of that year, he agreed with Mr. Joseph Dunbar, a planter from Mississippi, to take to his plantation some negroes and horses he had bought in Maryland. Arriving at Natchez, he worked at his trade until the autumn of 1820 when he was obliged to leave as the yellow fever was raging badly. At Judge Covington's, ten miles from Natchez, he was stricken with the fever and upon his recovery he worked upon several of the plantations. In the spring of 1820, he left for Boston, via New Orleans.

In September, 1821, he married Mary Drake of Stoughton. Leaving his wife at her father's home, he sailed for Natchez in October and worked for Thomas Freeland. He returned in the spring of 1822, agreeing to return in the fall. That summer he built him a house in Mechanic's Place. His return from Natchez on the following spring was accompanied by severe sickness and in January, 1823 he was working with Messrs. Stowell & Mears, who ran a machine shop. This was where he got his first knowledge of machinery.

By hard work he became head man of the place, but in the autumn of 1826, they failed. Owing him some two or three hundred dollars, he took some of their tools in pay. He then started a machine shop in the loft of Lewis' rope-walk in Roxbury with a Mr. John Bolling. Work consisted of repairs on the rope-walk and such jobs as they could get. It was here that they built their first steam engine, in 1826. His partner hanged himself and he bought out his widow for three hundred dollars.

In the autumn of 1828, he left the rope-walks and made a shop in the stable adjoining the house he lived in. Here he was successful in getting business of rope-walk machinery and small engines. Increasing business caused Mr. Hinkley to purchase a lot of land now on the corner of Curve Street and Harrison Avenue. Here he built his first shop and

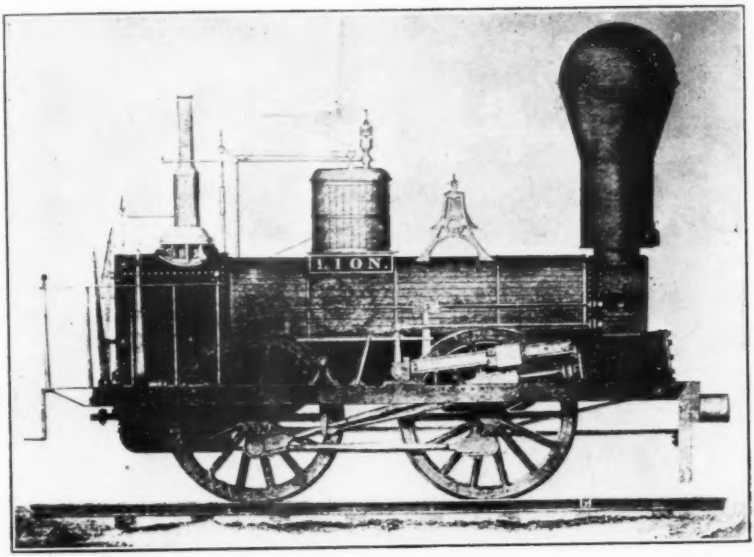

FIG. 1

Nashua & Lowell R. R. "Lion". Hinkley & Drury—Feb. 14, 1844

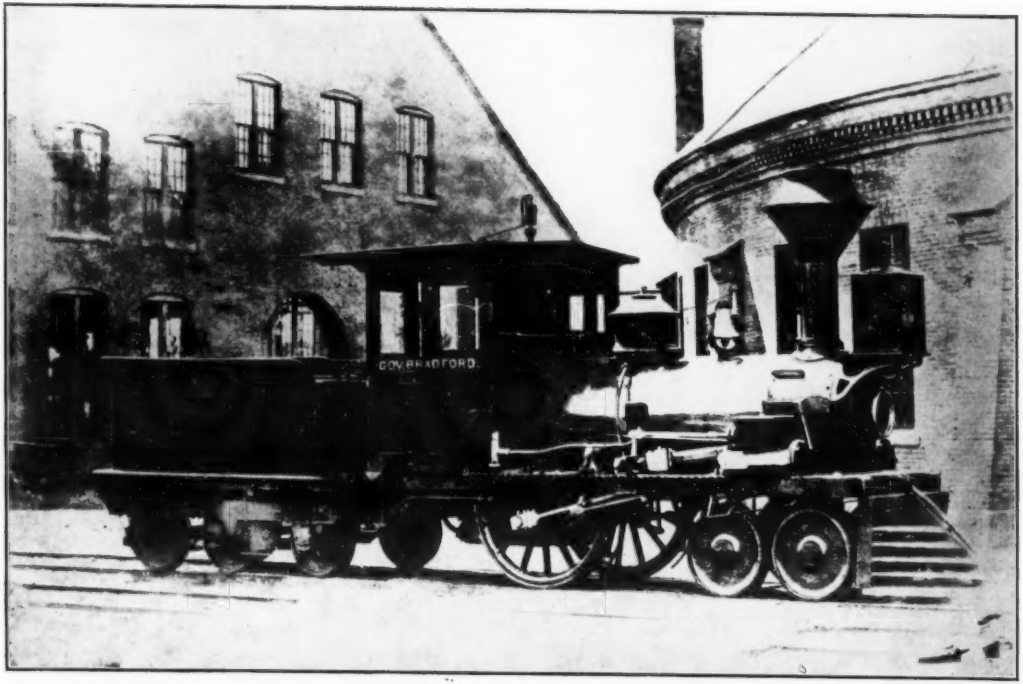

FIG. II

Old Colony R. R. "Gov. Bradford". Hinkley & Drury—Oct. 31, 1854.

FIG. III

Fitchburg R. R. "Shirley". Hinkley & Drury—Dec. 22, 1847

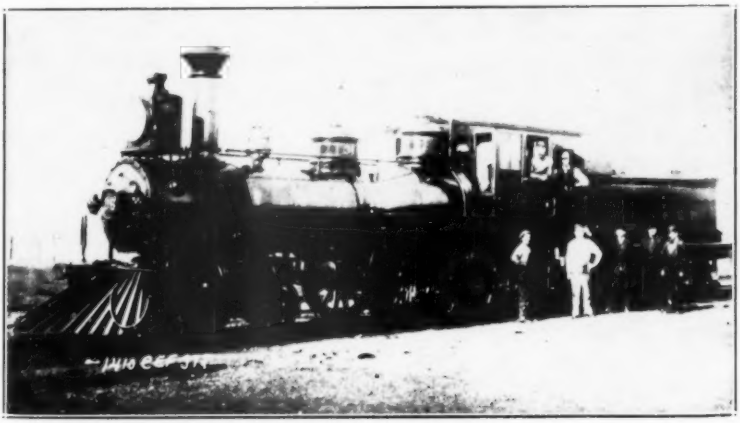

FIG. IV

New York & New England R. R. #36. Hinkley Loco. Wks. 1877

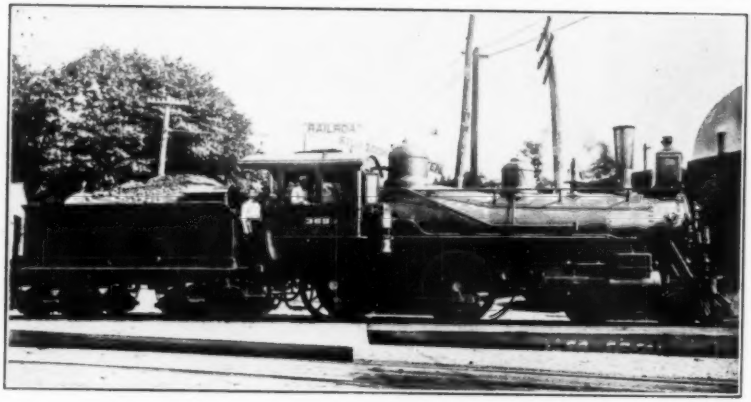

FIG. V

N. Y. N. H. & H. R. R. #365. Hinkley Loco. Wks. 1889

in the autumn of 1831 it was in readiness. In this shop Mr. Hinkley took Gardner P. Drury as partner. A year or two afterwords, Daniel F. Child was included in the partnership, to keep the books and act as treasurer.

In 1833 a lot of land on Washington Street was purchased. The flats were filled in and shops were built. These were in readiness in 1834 and as business increased more land was purchased and shops added.

In 1840, the "Cumberland", the first locomotive was built. Increasing business caused the Heath property to be purchased and additional shops to be built.

In 1848, the partnership was incorporated under the name of the Boston Locomotive Works, with a capital of four hundred thousand dollars. In 1852, Mr. Drury's interest was purchased by the other two incorporators and left Mr. Hinkley with the sole care of the shops. Giving up his Brookline home, he built a fine house at the corner of Ashland Place and Washington Street, to be near the works. Mr. Hinkley continued as manager until July, 1857 when he retired from the business.

In the autumn of that year came the financial crash. Mr. Hinkley felt that they should suspend business but the younger men decided to struggle along and mortgaged the Works and Mr. Hinkley's private property. In the fall of 1859 the concern failed.

Permission was granted Mr. Hinkley to operate the Works in a small way until April, 1861. Then, with Daniel F. Child, Adam Ayer and Jarvis Williams, a partnership was formed with these four men for a term of three years. The Heath property and some of the tools were purchased from the assignee and business was commenced. Through the efforts of Mr. Williams, contracts were obtained from the Government for guns, shot and shells.

In 1864 a stock company known as "Hinkley and Williams Works" was formed. Of a total of one hundred and sixty thousand dollars, Mr. Hinkley had a half interest and the other partners one third each.

In 1866, Mr. Hinkley was taken with peritonitis and died on February 8th, the same year of the death of Mr. M. W. Baldwin. Mr. Jarvis Williams took control of the works until his death in 1870. In that year they became known as the "Hinkley Locomotive Works" and after 1880 as the "Hinkley Locomotive Company". The works continued with varying success until 1889, when locomotive building ceased. The works were sold to the West End Railroad Company, now a part of the Boston Elevated Railroad Co., and the plant is now used for the purpose of generating electricity.

The plant had a frontage of three hundred feet on Albany Street, extending through to Harrison Avenue. It covered about six acres of ground. The main structure, of brick, erected in 1872, was three stories high and 80 by 290 feet. This building contained the offices, draughting room and machine shop. To the right was the blacksmith shop a building of 85 by 185 feet. To the rear of these two structures and extended in two parallel ranges were buildings of about 400 feet in length, containing the boiler shop and foundry. Between the two was the copper

and sheet iron shop, a building of 40 by 60 feet. Eastward of Albany Street, the company owned about one and one half acres of property extending to the South Bay. Here a wharf was built and much raw material received. A track laid on Albany Street connected the works with the railroads entering Boston and enabled the locomotives to be shipped complete, but not under steam, horses being used to pull the engine through the street. The works, when in full operation employed about one thousand men.

Turning now to the locomotives built, from first to last there were over 1800 locomotives built which can be credited to the Hinkley Works. Two locomotives of the mogul type delivered to the Old Colony R. R. in 1889 bore builder's numbers 1807 and 1811. During the years of the "Company", 487 locomotives were built. Between that time and the failure in 1857, 748 locomotives were constructed, while prior to 1857 over 600 locomotives were built.

In the Boston Public Library will be found a volume listing the first six hundred locomotives built during the years from 1841 to Dec. 5th, 1856. Subsequent records and drawings were given to the Massachusetts Institute of Technology and the authorities of that institution thinking they were of little value, destroyed them a few years ago. Otherwise the locomotive building history of this plant would be complete.

An examination of the early records reveals some interesting notes. Mr. Hinkley's first locomotives had only one pair of drivers in common with the builders of that period, also that many of his locomotives had outside cylinders and that he returned to the inside connected engine when these gave trouble. Like all other builders, at a latter date, he used the outside cylinders exclusively. But the chief difference in the early Hinkley locomotives lay in his departure of boiler construction. The English builders and the early builders in this country used a dome of hemi-spherical type, the tops of the inner fire-boxes following the contour of the outer dome. This was found to be unsatisfactory and was wholly abandoned in 1851. Hinkley on the other hand, used from the start a fire-box with a flat top almost of square construction, the domes conforming to the shape of his fire-box.

While neither Mr. Hinkley or the "Company" introduced no daring innovations in locomotive construction, it must not be overlooked that from the outset the locomotives were carefully and solidly built. Some of the Hinkley boilers were in continuous service for thirty-five years. One oddity that deserves mention was the "H. F. Shaw," built by the "Works" in 1881. This was a four-cylinder balanced engine, cylinders placed side by side transmitting the power to crank pins diametrically opposite each other. One of the crank pins connected outside the driving wheel at the same position an ordinary crank pin would be located, and carried a double crank, the midde of which was supported in a bearing secured in an outside frame. That bearing was the driving fulcrum, a main rod working each side of it. The engine was equivalent to one with two cylinders 16x24″, driving wheels 63″ and the weight in working order was 74,000 lbs. It was claimed this arrangement would reduce the pounding and oscillating of the two cylinder engine. The

engine was well built and used to a considerable extent in train service where it worked satisfactorily. The innovations however, were not taken kindly to by the railroad officials and no others of similar construction were ever built.

In closing however, it cannot be overlooked that the name of Hinkley will always be associated with locomotive construction in this country. The Hinkley locomotive went to every part of this country and always gave good performance by means of the careful design and sturdy construction.

The following is a list of the first one hundred locomotives built by Mr. Hinkley:

1 Portland, Saco & Portsmouth R. R., "Cumberland", July 27, 1841, 4-2-0, 10½x20" 54".
2. New Bedford & Taunton R. R., "Nantucket", Nov. 30, 1841, 4-2-0, 10½x20" 60".
3 Portland Saco & Portsmouth R. R., "York", Feb. 21, 1842, 4-2-0, 10½x-20" 60".
4 Concord R. R., "Pennacook", May 19, 1842, 4-2-0, 10½x20" 60".
5 Concord R. R., "Hooksett", June 27, 1842, 4-2-0, 10½x20" 54".
6 Boston & Worcester R. R., "Tiger", July 20, 1842, 0-4-0, 13½x20" 48".
7 Palmer & Machiasport R. R., "Tiger", Aug. 22, 1842, 0-4-0, 9x16" 42".
8 Concord R. R., "Amoskeag", Sep. 1842, 4-2-0, 10½x20" 60".
9 Concord R. R., "Souhegan", Sep. 22, 1842, 4-2-0, 10½x20" 54".
10 Portland Saco & Portsmouth R. R., "Saco", Oct. 25, 1842, 4-2-0, 10½x-20" 60"
11 Portland Saco & Portsmouth R. R., "Casco", Nov. 25, 1842, 4-2-0, 10½x-20" 60"
12 Charlestown Branch R. R., "Tudor", Dec. 26, 1842, 4-2-0, 10½x20" 60"
13 Boston & Worcester R. R., "Leopard", Mar. 14, 1843, 2-2-2, 13½x20" 48"
14 Boston & Maine R. R., "Portland", Mar. 16, 1843, 4-2-0, 11½x20" 63"
15 Western R. R., "Boston", Apr. 18, 1843, 0-4-0, 15x20" 48"
16 Boston & Worcester R. R., "Panther", June 26, 1843, 0-8-0, 13½x20" 36"
17 Western R. R., "St. Louis", July 7, 1843, 4-4-0, 13½x20" 60"
18 Concord R. R., "Piscataquog", July 9, 1843, 4-2-0, 10½x20" 60"
19 Western R. R., "Cincinnati", Sep. 4, 1843, 4-4-0, 13½x20" 60"
20 Fitchburg R. R., "Charlestown", Nov. 8, 1843, 4-4-0, 11½x20" 63"
21 Fitchburg R. R., "Fitchburg", Dec. 14, 1843, 4-4-0, 11½x20" 63"
22 Nashua & Lowell R. R., "Lion", Feb. 14, 1844, 0-4-0, 13½x20" 54"
23 Fitchburg R. R., "Vermont", June 25, 1844, 4-4-0, 13½x20" 60"
24 Long Island R. R., "Derby", Sept. 13, 1844, 4-4-0, 13½x20" 66"
25 Fitchburg R. R., "Keene", Sept. 16, 1844, 4-4-0, 13½x20" 60"
26 Boston & Worcester R. R., "Camel", Sep. 25, 1844, 4-8-0, 13½x20" 36"
27 Fitchburg R. R., "Brattleboro", Sep. 28, 1844, 4-4-0, 13½x20" 60"
28 Fitchburg R. R., "Burlington", Nov. 19, 1844, 4-4-0, 13½x20" 60"
29 Charlestown Branch R. R., "Aetna", Dec. 14, 1844, 4-4-0, 12x20" 48" O C
30 Boston & Maine R. R., "Reading", Dec. 30, 1844, 4-2-2, 11½x20" 66"
31 Fall River R. R., "Mt. Hope", Jan. 1, 1845, 4-2-0, 11½x20" 60"
32 Boston & Maine R. R., "Malden", Feb. 6, 1845, 4-2-0, 11½x20" 60"
33 Boston & Lowell R. R., "Milo", Feb. 10, 1845, 4-4-0, 13½x20" 54" O C
34 Fall River R. R., "Fall River", Feb. 20, 1845, 4-2-0, 13½x20" 60" O C
35 Eastern R. R., "Boston", Mar. 3, 1845, 4-4-0, 13½x20" 60" O C
36 Boston & Lowell R. R., "Ajax", Mar. 21, 1845, 0-4-0, 13½x20" 54" O C
37 Boston & Worcester R. R., "Mercury", Mar. 31, 1845, 4-4-0, 14x18" 66" 33200# O C

38 Portland Saco & Portsmouth R. R., "Montreal", Apr. 7, 1845, 4-4-0, 13½ x20" 60"
39 Boston & Worcester R. R., "Jupiter", Apr. 29, 1845, 4-4-0, 14x18" 66"
40 Norwich & Worcester R. R., "Rockwell", Apr. 29, 1845, 4-4-0, 13½x-20" 66"
41 Buffalo & Niagara R. R., "Niagara", May 15, 1845, 4-2-2, 11½x20" 60" O C
42 New Bedford & Taunton R. R., "Hercules", May 22, 1845, 4-4-0, 13½ x20" 60" O C
43 Concord R. R., "Suncook", May 23, 1845, 4-4-0, 13½x20" 54" O C
44 Eastern R. R., "Portland", June 20, 1845, 4-4-0, 13½x20" 60" O C
45 Fitchburg R. R., "Alvah Crocker", July 24, 1845, 4-4-0, 15x20" 54" O C
46 Long Island R. R., "Boston", July 29, 1845, 4-4-0, 14¼x20"54" O C
47 Old Colony R. R., "Mayflower", Aug. 1, 1845, 4-2-0, 11½x20" 60" O C
48 Boston & Maine R. R., "Swampscott", Aug. 5, 1845, 0-4-0, 13½x20" 54" O C
49 Western R. R., "Springfield", Aug. 6, 1845, 4-4-0, 13½x20" 60" O C
50 Fitchburg R. R., "Waltham", Aug. 30, 1845, 4-4-0, 15x20" 54" O C
51 Old Colony R. R., "Gov. Carver", Sep. 15, 1845, 4-2-0, 11½x20" 60" O C
52 Boston & Maine R. R., "Antelope", Sep. 19, 1845, 4-2-0, 11½x22" 72" O C
53 Old Colony R. R., "Gov. Bradford", Oct. 31, 1845, 4-2-0, 11½x20" 60" O C
54 Old Colony R. R., "Miles Standish", Oct. 31, 1845, 4-2-0, 11½x20" 60" O C
55 Springfield & Northampton R. R., "Holyoke," Nov. 17, 1845, 4-4-0, 13½x20" 60" O C
56 Boston & Maine R. R., "Bangor", Dec. 8, 1845, 4-4-0, 14x18" 60"
57 Boston & Maine R. R., "Massachusetts", Feb. 5, 1846, 4-4-0, 14x18" 60"
58 Boston & Worcester R. R., "Comet", Mar. 5, 1846, 4-4-0, 14x18" 66"
59 Springfield & Northampton R. R., "Greenfield", Mar. 23, 1846, 4-4-0, 13½x20" 60" O C
60 Boston & Worcester R. R., "Ajax", Apr. 8, 1846, 4-4-0, 15x20" 54"
61 Old Colony R. R., "Express", Apr. 8, 1846, 4-2-0, 14x20" 67½" O C. Renamed "Quincy" by the road.
62 Palmer & Machiasport R. R., "Lion", May 4, 1846, 0-4-0, 9x16" 42" O C
63 Macon & Western R. R., "Gov. Crawford", May 11, 1846, 4-4-0, 12x18" 60"
64 Boston & Worcester R. R., "Hercules", June 17, 1846, 4-4-0, 15x20" 54"
65 Old Colony R. R., "Patuxet", June 20, 1846, 4-4-0, 13½x20" 60" O C
66 Fall River R. R., "Randolph", July 2, 1846, 4-4-0, 14x18" 66"
67 Macon & Western R. R., "Asbury Hall", July 9, 1846, 4-4-0, 12x18" 60"
68 Macon & Western R. R., "Jerry Cowles", July 10, 1846, 4-4-0, 12x18" 60"
69 Western R. R., "Vermont", July 10, 1846, 4-4-0, 16x20" 54" O C
70 Eastern R. R., "Portsmouth", July 22, 1846, 4-4-0, 15x20" 54" O C
71 Western R. R., "Maine", Aug. 6, 1846, 4-4-0, 16x20" 54" O C
72 Western R. R., "Pittsfield", Aug. 11, 1846, 4-4-0, 13½x20" 60" O C
73 Michigan Central R. R., "Battle Creek", Aug. 27, 1846, 4-4-0, 15x20" 54"
74 Western R. R., "Washington", Sept. 7, 1846, 4-4-0, 13½x20" 60" O C
75 Portland Saco & Portsmouth R. R., "Atlantic", Sep. 12, 1846, 4-4-0, 14x18" 60"
76 Northern R. R., "Contoocook", Sep. 17, 1846, 4-4-0, 14x18" 60"
77 Fall River R. R., "Bridgewater", Sep. 26, 1846, 4-4-0, 14x18" 66"
78 Michigan Central R. R., "Hercules", Oct. 3, 1846, 4-4-0, 15x20" 54"
79 Western R. R., "Connecticut", Oct. 17, 1846, 4-4-0, 15x20" 54" O C
80 Connecticut River R. R., "Northampton", Oct. 23, 1846, 4-4-0, 12x18" 60"
81 Western R. R., "Virginia", Nov. 13, 1846, 4-4-0, 16x20" 54" O C

82 Eastern R. R., "St. Lawrence", Nov. 16, 1846, 4-4-0, 14x18" 60"
83 Fall River R. R., "Middleboro", Dec. 2, 1846, 4-4-0, 15x20" 54"
84 Western R. R., "Kentucky", Dec. 5, 1846, 4-4-0, 16x20" 54" O C
85 Western R. R., "Tennessee", Dec. 17, 1846, 4-4-0, 16x20" 54" O C
86 Old Colony R. R., "Kingston", Dec. 24, 1846, 4-4-0, 14x18" 60"
87 Concord R. R., "Merrimac", Jan. 9, 1847, 4-4-0, 15x20" 54" O C (?)
88 Northern R. R., "Wannalancet", Jan. 11, 1847, 4-4-0, 14x18" 60"
89 Fall River R. R., "Braintree", Jan. 21, 1847, 4-4-0, 15x20" 54"
90 Connecticut River R. R., "Brattleboro", Jan. 22, 1847, 4-4-0, 12x18" 60"
91 Nashua & Lowell R. R., "Nashville", Feb. 1, 1847, 4-4-0, 14x18" 60"
92 Fall River R. R., "Boston", Feb. 11, 1847, 4-4-0, 14x18" 66"
93 Boston & Maine R. R., "New Hampshire", Mar. 18, 1847, 4-6-0, 16x20" 46"
94 Boston & Worcester R. R., "Rocket", Mar. 23, 1847, 4-4-0, 15x18" 66"
95 Vermont & Massachusetts R. R., "Gardner", Mar. 30, 1847, 4-4-0, 14x18" 60"
96 Boston & Worcester R. R., "Neptune", Mar. 30, 1847, 4-4-0, 15x18" 66"
97 Michigan Central R. R., "Reindeer", Apr. 21, 1847, 4-4-0, 15x20" 54"
98 North Adams R. R., "Greylock", Apr. 26, 1847, 4-4-0, 14x18" 60"
99 Western R. R., "Louisiana", Apr. 30, 1847, 4-4-0, 16x20" 54"
100 Western R. R., "Iowa", May 6, 1847, 4-4-0, 16x20" 54"

OC: Outside Connected.

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Locomotives of The Grand Trunk Railway

Recollections of the picturesque engines that served the great Canadian railway together with historic notes in passing.

By JOHN LOYE

THE subject selected for this article is one we can scarcely hope to do justice to, so wide and comprehensive is its perspective and diversified and peculiar the objects comprised in the collection that memory brings in its passing train of sixty years. We can see them in the picture gallery of our mind, in all their majestic power and polished beauty, and wish in our heart that we had the pen to vividly portray them. We are naturally prone to view in retrospect the attending scenes that give back-ground to the objects we dwell upon, in that we may partake of the life and color of the days wherein they shone. We must step from this present era and live in the light of the fifties and sixties again. We must envisage the frontal grandeur of the wood-burner coming over Beloeil bridge, where the Richelieu rolls down by Mount Ste. Killaire. We must dream of a gaudy red-wheeler that sparkles in the sunshine as it flits along through the groves of Blue Bonnets and hear its plaintive bell. We fancy we can breathe the burning tamarack and maple in the brownish cloud that blows about us from the smoking funnel at Crankshaw's crossing. Thus, as we take our way back through the vanished past, we can review what comes before us.

ENGINES OF THE EARLY DAYS

No railway in America, or in the world for that matter, has had in its time so many picturesque and different locomotives as the Grand Trunk Railway. The absorption of so many lines as it progressed brought into its yards engines of every prominent maker in America, as well as many quaint specimens from Great Britain rebuilt to American ideas. Unfortunately but few of these locomotives have been preserved to us in photographs and only the memory of them remains after the passing of the years.

Time was when their names were as familiar as those of the country's leading citizens and they were, indeed, like individuals in their community. For the locomotive, like no other piece of mechanism, engaged the interest of the public from its first appearance. Its semblance to life, its air of pride and individuality and its seeming expression of a will and power to achieve high tasks for the line it served, all these features brought the locomotive into intimate relation with the people. For, after all, it was the locomotive that empowered the railway and made it what it is. It was the locomotive rather than the railroad that revolutionized the world.

THE ORIGIN OF THE GRAND TRUNK RAILWAY

In the early forties, the business men of Portland, Maine, began an agitation for a railroad connection with the Canadas and the United States. Due to their initiative the business interests of Montreal began a like movement which culminated in a mutual agreement between both parties—Americans and Canadians, to build a line of railroad from Longueuil, opposite Montreal, to Portland, Maine.

Early in 1844 the State of Maine issued a charter to the Atlantic & St. Lawrence Railroad, and in March, 1845, the Province of Lower Canada, with the Imperial assent, issued a charter to the St. Lawrence & Atlantic Railway. The international boundary was the objective or meeting point of these kindred lines each working from its own terminal. While the construction progressed a wider agitation gained force in Canada. In 1849 a mass meeting was held in St. Lawrence Hall, Montreal, where it was resolved that the systems then under way should be combined, enlarged and extended.

British capital became interested and a company was formed to amalgamate the Montreal-Portland line with several others building or planned. A charter was issued in 1852 to the Grand Trunk Railway of Canada as the result of this feeling.

The building of the Montreal to Portland line involved the erection of the first great transfluvian bridges that made the Canadian railroad famous. The one at Beloeil, over the Richelieu river was Canada's first notable bridge. It was completed in the autumn of 1848 and consisted of a series of masonry and timber piers which carried timber trusses. On one central pier, a truss on a turn-table swung open to permit the passage of river craft. This arrangement led to a terrible catastrophe here in July, 1864, when a train load of German immigrants plunged through the open draw and engine and cars were precipitated upon a sailboat which was passing through.

On June 18th, 1853, the rails of the Atlantic & St. Lawrence were linked with those of the St. Lawrence & Atlantic at Island Pond, Vermont, and in the same week the deed was consummated which incorporated the two lines in the new Grand Trunk Railway. Thus it will be seen that the great Canadian system originated in the City of Portland, Maine.

THE PORTLANDS

The leading place in our fanciful review of Grand Trunk locomotives is taken by that once famous line of engines, the Portlands, the products of the long established works in Portland, Maine. They first appeared in Canada in 1848, when one engine was delivered to the St. Lawrence & Atlantic Railway. In appearance it closely resembled the "Lady Elgin," (Fig. I), but did not have the projecting headlight or the spherical sand-box. The engine bore the name "A. N. Morin" and was delivered at Longueuil in October of 1848.

The Portland Locomotive Works came into being in 1846 and its subsequently supplied the most of the early motive power that worked the

system. Their first engine was the "Augusta," built in July, 1848 for the Portland, Saco & Portsmouth R. R., now part of the Boston & Maine R. R. The second engine was the "Montreal," built September, 1848 for the Atlantic & St. Lawrence R. R. and the third engine was the already mentioned "A. N. Morin," named for Augustine Norbert Morin, first President of the St. Lawrence & Atlantic Ry. This engine was later listed as No. 1 on the Grand Trunk roster of 1859. It was a 4-4-0 type of 23.10 tons, with inside cylinders of 15x22" and drivers of 5'-0". It had a great balloon stack, brass rails along the sides with the dome placed next to the stack, the former being wood cased and capped and bound with brass and mounted on a square pedestal. The engine carried a small head light, brass ribs on a planished saddle-topped boiler, with a bell and steam pipe next to the cab. The sand-box was under the running board, but of this we are not certain.

For the benefit of our readers the following lists of Portland engines built for the two roads may be of interest.

The following engines were delivered to the Atlantic & St. Lawrence R. R., from 1848 to 1853:

PLW #							
	2	"Montreal"	Sept.	1848	15x22"	60"	I C
	5	"Machigonne"	Dec. 30,	1848	"	"	I C
	6	"Oxford"	Feb. 24,	1849	"	"	I C
	8	"Wm. P. Prebble"	May 16,	1849	14x20"	"	I C
	13	"Waterville"	Dec. 30,	1849	15x20"	66"	I C
	14	"Coos"	Feb. 1,	1850	"	"	I C
	19	"Felton"	Jan.	1851	15x20"	60"	I C
	20	"Railway King"	June	1851	17x22"	54"	I C
	28	"Casco"	Dec.	1851	14x20"	60"	I C
	29	"Forest City"	Jan.	1852,	15x20"	66"	I C
	30	"Danville"	Mar.	1852,	13x20"	60"	I C
	32	"Falmouth"	May	1852,	14x22"	60"	I C
	36	"Daniel Webster"	Nov.	1852,	15x20"	60"	I C
	40	"Cumberland"	Jan.	1853,	16x22"	60"	I C
	41	"Norway"	Apr.	1853,	"	"	I C
	42	"Nulhegan"	June 27,	1853,	14x22"	66"	I C
	43	"Paris"	Apr. 11,	1853,	15x22"	60"	I C
	44	"Gloucester"	June 23,	1853,	15x22"	66"	I C
	45	"Yarmouth"	May 23,	1853,	15x22"	60"	I C
	46	"Amonoosuc"	June 13,	1853,	"	"	I C
	48	"Vermont"	Sep. 20,	1853,	16x22"	60"	O C
	49	"Gorham"	Nov. 16,	1853,	14x22"	72"	I C
	50	"Oxford"	Mar.	1854,	15x22"	60"	I C
	56	"J. S. Little"	Dec. 1,	1853,	15x22"	72"	I C

The following engines were delivered to the St. Lawrence & Atlantic Ry. from 1848-1854:

PLW #							
	3	"A. N. Morin"	Oct.	1848,	15x22"	60"	I C
	15	"Montreal"	May 31,	1850,	15x20"	66"	I C
	17	"Sherbrooke"	Sep.	1850,	16x22"	66"	I C
	25	"St. Lawrence"	Aug. 28,	1851,	15x20"	66"	I C
	26	"Richelieu"	Nov. 1,	1851,	16x22"	66"	I C
	27	"Yamaska"	Nov. 1,	1851,	15x22"	60"	I C
	34	"Queen"	Aug.	1852,	16x22"	66"	I C
	35	"Massawippi"	Aug.	1852,	16x24"	54"	I C
	57	"Berlin"	Jan. 9,	1854,	14x20"	66"	O C
	58	#26	Jan. 10,	1854,	"	"	O C

59 "St. J. Smith"	Feb. 14, 1854,	14x22″	72″	I C
60 "Stratford"	Feb. 15, 1854,	"	"	I C
61 "Bethel"	Feb.	1854, 15x22″	60″	I C

I C = Inside Connected O C = Outside Connected.

It would appear that P. L. W. Nos. 6 and 50 were the same engine, No. 50 being rebuilt by the Portland Co. and assigned another number on their books.

The design of the earlier Portlands were all of the eight wheel type, which for sixty years was the standard in American passenger engine design, and to a large extent with the freight engines as well. The first Portlands were not beautiful. They were characterized by vast funnels and broad frames with a railing along the wide running board on each side and across the pilot. The boiler lagging was of Russia iron with brass ribs and the dome and sand box were jacketed in staved ash or oak in natural color bound around with hoops of brass. There was no defined color scheme or remarkable decoration. The engines were painted where necessary in dark serviceable hues. The average weight was 23 tons. The cylinders varied in dimensions, 15x20″ and 22″ stroke, and 16x20″ and 22″ stroke for both passenger and freight service. The driving wheels of the former were 66″ diameter and those of the latter were 60″.

Because of the broad gauge of the Portland-Montreal and G. T. R. lines, 5′-6″, all the first deliveries were narrow-backed inside cylindered engines. It was not until September, 1853 that the Portland Works produced an outside cylindered engine on the broad gauge. This was the "Vermont" for the A. & St. L. division of the G. T. R. On January 9th, 1854, the "Berlin" was delivered to the St. L. & A. division. (See Fig. II). From this time the outside cylinder gained in favor and eventually was uniformly adopted.

The Portland locomotives had a marked influence on the practice of the first Canadian builders, both in Montreal and Toronto. In the latter city the engine "Lady Elgin," (See Fig. I) furnished the pattern after which James Good built the "Toronto," (See Fig. III), in 1853. This engine hauled the first passenger train out of Toronto in the summer of that year. It has been stated that the "Toronto" was a rebuilt Portland engine, the "Josephine," originally. This is erroneous, the "Toronto" was built from the ground up. (See Fig. XXIX, Addenda).

The Portland engines were powerful and efficient for their day and designed to withstand the strains and jolts of running on the rough and ready railroad over which they travelled. By 1853 they began to assume a more refined and symmetrical character with graceful funnels. (See Fig. II). For the balance of the 50's their appearance changed but slightly, but many bore the mushroom stack instead of the funnel. As the 60's progressed a splendid type of engine was evolved. (See Fig. IV). Many of these came to the Grand Trunk before the change of gauge from 5′-6″ to 4′-8½″ in 1873. Following this change many of these engines were rebuilt to suit the new conditions as were a number of the older types. (See Fig. V). At the change of gauge and down through

the 70's, the Portland Works built engines for the Grand Trunk and these were among the finest engines in America. (See Fig. VI).

So here we may cease to dwell upon the Portlands, those sturdy nation builders of the picturesque era when America was spreading her settlements over the western plains, piercing the forest and crossing the rivers and ravines with her pioneer railroads. In the world of eighty years ago, in the days of the gas-lit depot, the horse drawn omnibus and the busy city scenes in America before the Civil War, they brought the immigrant from the sea-board harbor to his western home and carried the produce of the Canadas down to the ships by the sea.

THE KINMONDS

When the Montreal & Lachine Railway was opened in November 1847, the citizens of Montreal saw for the first time a locomotive at the Bonaventure Depot. The first locomotives on this line were the "Montreal" and the "James Ferrier," the latter named for the President of the road. The road was nine miles in length and of 4'-9" gauge. These locomotives were built by Kinmond Brothers of Dundee, Scotland, and were of some sixteen tons weight and of the 2-2-2 type. At the time of their delivery in Canada the air was full of plans and schemes for projected railroads and the country seemed a promising one wherein to establish locomotive works. The Kinmonds received additional orders from the Lachine road and also from the Champlain & St. Lawrence, the first railway in Canada, opened from Laprairie to St. Johns, P. Q., in July, 1836. Encouraged by the prospect of increasing patronage, the Kinmonds embarked on the enterprise of establishing a locomotive works in Montreal in 1852, when the Grand Trunk venture became assured. Their plant was located on the ground now comprised in the western extension of Chaboillez Square, adjoining the old Bonaventure Depot.

In September of 1853, the first Canadian Kinmond was delivered to the Grand Trunk Railway. In appearance it resembled a Portland and unmistakably followed that design. Unlike the Portlands, it had a full smooth shaped dome placed over the fire-box. It weighed, of itself, twenty-six tons and embodied the best features of contemporary practice. It was a 4-4-0, American type, with 60" drivers, inside cylinders, 16x24" and was the first locomotive built in Montreal and the second in Canada.

The Kinmonds built ten engines for the Grand Trunk Railway and one for the Carillon & Grenville Ry., 1854, at that time known as the Montreal & By-town R. R. (See Fig. VII). The Kinmonds anticipated a more general patronage from the Canadian lines than they obtained. They had difficulty in competing with the Portland, Amoskeag, Boston and New Jersey makers, and ceased to build locomotives in November of 1856 when they delivered engine No. 87 to the Grand Trunk Ry. This engine weighed 28.2 tons and was for passenger service. It had 66" drivers.

Mr. Robert R. Brown in his article on the Kinmonds, (Bulletin No. 22), attributes the failure in 1857 to the depression following the close of the Crimean War and this is evidently true. Mr. Brown also

noted that the records show eight engines built for the Grand Trunk Ry. during the years 1853-1854, but that only seven are listed in the report of 1859, (for those years), and states, "so we can only conclude that one was wrecked or otherwise disposed of some time between 1854 and 1859." In 1856 a G. T. R. locomotive was lost by sinking in the marshes of St. Henry, a suburb of Montreal. It was stated at the time to have been a new engine, so we may reasonably surmise that it was the missing Kinmond. And so ended in failure a promising venture, and closed the career of a works whose products merited more fuller recognition from the country they were designed to serve.

THE BIRKENHEADS

To the old time railroader, so few of whom survive today, the name, Birkenhead, envisions something picturesque and romantic. The name, the character and origin of these quaint locomotives from over the sea invested them with an air that was all their own, making for them a place in the annals of early Canadian engines that seems quite apart from all others.

In Bulletin 18 we told their story and described them especially. They came to the Grand Trunk Railway, some fifty in all, from the Canada Works established in Birkenhead, England, by the firm of Peto, Brassey & Betts & Jackson, in 1853, for the purpose of building a quota of the motive power of the Grand Trunk Railway, in whose general construction the firm was engaged. Their building and delivery covered a period of four years, 1854-1858.

Alexander Allen, the famous locomotive designer and builder of Crewe, was the consulting engineer of the Canada Works, and his practice, as exemplified in his contemporary engines on the London & Northwestern Railway, was fully apparent in the Birkenheads. The first delivery was made in November, 1854. The engine was of the 2-4-0 type, passenger, with 72″ driving wheels, cylinders 15x20″ and weighed 25.5 tons. It has been stated that this engine was named "Lady Elgin" after the wife of the then Canadian Governor General, but it would appear to have borne only its number, 41, while in the Grand Trunk service. Subsequent deliveries continued of the 2-4-0 type, the passenger engines having 72″ drivers, the freight engines 60″ drivers. The wheel arrangement was impracticable, it was found, and in every instance the single pair of leading wheels was removed and replaced by a bogie truck, making the engines into a 4-4-0 type. There were several passenger engines of the 2-2-2 wheel arrangement, with a single pair of 72″ driving wheels. These were also rebuilt to the 4-4-0 type and are so described in the Grand Trunk roster of locomotives of 1859.

The first arrivals were stolid and rather unpleasing in appearance. (See Fig. VIII). Towards the close of the contract they developed a more graceful and symmetrical design, (See Fig. IX) and were already equipped with bogie trucks.

The Birkenheads were said to have been the only engines at that time on the Grand Trunk Railway, or on any other Canadian or American line, possibly, that were painted all over, even the boiler lagging being heavily coated with green, red or black paint. They displayed little

brass, but it was said they were very attractive and good to look at when new. They were the most durable engines on the Grand Trunk and when the road was changed to standard gauge in 1873, some twenty-five were rebuilt and continued in service for years afterwards.

From its inception, the Grand Trunk Railway gave many evidences of its English parentage. This applied not only to its locomotives but in its working and organization. From 1853 to 1906 it ran its trains on the left where there was double track and all the Birkenheads had the drive on the left side. Mr. Herbert A. Pangborn, (See Fig. X), a veteran engine driver, has told us of his first charge when he joined the Grand Trunk at Brockville in 1866. It was a Birkenhead, painted green all over, and awkward to drive because the throttle worked from the left and awkward to fire as well.

In addition to the three builders of locomotives we have already mentioned, the Grand Trunk Railway prior to 1859, had acquired or ordered many locomotives from other notable builders as shown in the following list:

GRAND TRUNK RAILWAY OF CANADA

Locomotive Department

Analysis of "Statement" showing Leading Particulars of Engine Stock: Of the 203 engines forming our present stock the following is a summary of the places of manufacture, &c.

	Pass.	Frt.	Total
Amoskeag Co.	4	32	36
Manchester Loco. Wks.	7	3	10
Boston Loco. Wks.	3	7	10
New Jersey Loco. Wks.	2	0	2
Portland Company	21	31	52
Canada Works, Birkenhead	14	36	50
Kingston Loco. Works	10	6	16
Hamilton Loco. Works	9	2	11
Kinmond Bros. Montreal	6	4	10
Good, Toronto	2	3	5
Company's Wks, Point St. Charles	0	1	1
	78	125	203
The United States	37	73	110
The Canadas	27	16	43
England	14	36	50
	78	125	203
Distribution of Engines			
Portland Section	16	25	41
Eastern Section	26	32	58
Central Section	28	51	79
Western Section	8	17	25
	78	125	203
Condition of engines			
In good working order	65	78	143
In fair working order	1	14	15
Working but requiring repairs	4	9	13

Having heavy repairs	8	13	21
Having light repairs	0	11	11
	78	125	203

W. S. MacKENSIE

Point St. Charles, October, 1859

GRAND TRUNK RAILWAY OF CANADA

Statement of Locomotives as of October 1859

					Tons	C't.
1	Portland Co.	1848	15x22"	60"	23	16
2	"	1850	"	66"	23	8
3	"	1851	16x22"	"	23	14
4	"	"	15x20"	"	23	5
5	Peto & Co.	1855	"	72"	25	5
6	"	"	"	"	25	5
7	Boston Works	1852	16x24"	66"	23	9
8	"	"	"	"	23	9
9	Portland	1851	15x22"	"	24	2
10	Kinmond	1854	14x21"	"	22	6
11	Amoskeag	1852	16x24"	54"	23	6
12	"	"	"	"	23	6
13	"	"	16x20"	66"	23	6
14	Portland	1858	16x22"	60"	25	10
15	Amoskeag	1853	16x24"	54"	25	10
16	"	"	16x20"	66"	25	10
17	Kinmond	"	16x24"	"	26	2
18	Amoskeag	"	"	54"	25	2
19	"	"	16x20"	66"	25	2
20	Kinmond	"	15x24"	60"	26	12
21	Boston Works	1854	16x20"	66'	24	16
22	"	"	"	"	24	16
23	Peto & Co.	1855	15x20"	72"	23	12
24	Boston Works	1854	17x20"	60"	24	16
25	Kinmond	"	15x21"	66"	28	2
26	Portland Co.	"	14x22"	"	21	2
27	Amoskeag	"	14x20"	60"	21	2
28	"	"	"	"	21	2
29	Kinmond	"	16x24"	"	26	12
30	"	"	"	66"	26	2
31	"	"	"	60"	26	12
32	Amoskeag	"	"	"	27	12
33	"	"	16x24"	"	27	12
34	Good	"	16x22"	66"	26	0
35	New Jersey Works	"	17x20"	72"	26	12
36	"	"	"	72"	26	12
37	Amoskeag	"	16x20"	60"	25	6
38	"	"	"	"	25	6
39	"	1855	"	"	25	6
40	"	"	"	"	25	6
41	Peto & Co.	1854	15x20"	72"	25	5
42	"	1855	"	"	25	5
43	"	"	"	"	25	5
44	"	"	"	"	25	5
45	"	"	"	"	23	12
46	"	"	16x20"	60"	25	12
47	"	"	"	"	25	12
48	"	"	"	"	25	12

49	"	1856	"	"	25	12
50	"	"	"	"	25	12
51	"	"	"	"	25	12
52	"	"	15x20"	72"	25	5
53	Boston Works	1854	17x20"	60"	24	16
54	Portland	1855	15x24"	"	23	16
55	"	1856	"	"	23	16
56	"	"	16x20"	"	24	16
57	Peto & Co.	1858	"	"	25	12
58	"	"	"	"	25	12
59	"	"	"	"	25	12
60	"	"	"	"	25	12
61	"	"	"	"	25	12
62	"	1855	"	"	25	12
63	"	"	"	"	25	12
64	"	1856	"	"	25	12
65	"	1855	15x20"	72"	25	5
66	"	1856	"	"	25	5
67	"	1855	"	"	25	5
68	Portland	1856	16x20"	66"	24	12
69	Peto & Co.	1855	15x20"	72"	25	5
70	"	1856	"	"	23	12
71	Kinmond	"	15x21"	66"	28	2
72	Portland	"	16x20"	60"	24	16
73	"	"	"	"	24	16
74	Peto & Co.	"	"	"	25	12
75	"	"	"	"	25	12
76	"	"	"	"	25	12
77	"	"	"	"	25	12
78	"	"	"	"	25	12
79	"	"	"	"	25	12
80	"	"	"	"	25	12
81	"	"	"	"	25	12
82	"	"	"	"	25	12
83	Peto & Co.	1856	16x20"	60"	25	12
84	"	"	"	"	25	12
85	"	"	"	"	25	12
86	Kinmond	"	15x21"	66"	28	2
87	"	"	"	"	28	2
88	Ontario Foundry	"	15x20"	"	24	2
89	"	"	"	"	24	2
90	"	"	"	"	24	2
91	"	"	"	"	24	2
92	"	"	"	"	24	2
93	"	1857	"	"	24	2
94	Manchester	1856	"	72"	25	6
95	"	"	"	"	25	6
96	"	"	"	"	25	6
97	"	"	"	"	25	6
98	"	"	"	"	25	6
99	"	"	"	"	25	6
100	"	"	"	"	25	6
101	Portland	1848	15x22"	60"	23	10
102	"	"	"	"	23	10
103	"	1849	"	"	22	15
104	"	"	15x20"	66"	24	14
105	"	"	"	"	22	7
106	"	1850	"	"	22	8
107	"	1851	15x22"	60"	22	8
108	"	"	17x22"	"	24	4
109	"	"	14x20"	"	22	7

110	"	1852	15x20"	66"	22	7
111	"	"	13x20"	60"	20	0
112	"	"	14x22"	54"	22	12
113	"	"	15x20"	60"	22	7
114	"	1853	16x22"	"	24	4
115	"	"	14x22"	66"	21	9
116	"	"	15x22"	60"	23	10
117	"	"	16x22"	"	24	4
118	"	"	15x22"	"	24	0
119	"	"	"	"	24	0
120	"	"	"	66"	23	8
121	"	"	16x22"	60"	24	4
122	"	"	14x22"	72"	22	0
123	"	"	15x22"	"	23	10
124	Boston Works	1854	15x24"	60"	23	17
125	"	"	"	"	23	17
126	Portland	1854	15x20"	66"	22	7
127	"	1857	16x20"	60"	25	10
128	"	1854	15x22"	"	22	17
129	"	"	"	"	22	17
130	"	"	14x22"	72"	21	19
131	"	"	"	"	21	19
132	"	"	14x20"	66"	21	0
133	Boston Works	"	17x20"	60"	24	16
134	"	"	16x20"	66"	24	16
135	Portland	1857	"	"	25	18
136	"	1854	"	"	24	16
137	" ..	1852	16x24"	60"	28	16
138	Good	1854	16x20"	"	26	0
139	Portland	1851	15x22"	"	24	4
140	"	1852	16x22"	"	24	4
141	Good	1856	16x20"	"	26	0
142	"	1858	17x20"	66"	27	0
143	"	1857	16x20"	60"	26	0
144	Portland	1859	16x22"	"	29	16
145	Peto & Co.	1856	16x20"	"	25	12
146	"	"	"	"	25	12
147	Manchester	"	"	"	25	6
148	"	"	"	"	25	6
149	"	"	"	"	25	6
150	Amoskeag	"	"	"	25	6
151	"	"	"	"	25	6
152	"	"	"	"	25	6
153	"	"	"	"	25	6
154	"	"	"	"	25	6
155	"	"	"	"	25	6
156	"	1857	"	"	25	6
157	"	1856	"	"	25	6
158	"	"	"	"	25	6
159	"	1857	"	"	25	6
160	"	1856	"	"	25	6
161	"	"	"	"	25	6
162	"	"	"	72"	25	6
163	"	"	"	60"	25	6
164	"	"	"	60"	25	6
165	Portland	1857	"	"	25	10
166	"	"	"	60"	25	10
167	"	1858	16x22"	60"	29	16
168	Hamilton Wks	1857	15x21"	66"	29	16
169	Hamilton Works	1857	15x21"	66"	29	16
170	"	"	"	"	29	16

171	Kingston Works	"	16x22"	56"	24	2
172	"	"	"	"	24	2
173	"	"	16x20"	60"	24	2
174	"	"	"	"	24	2
175	Amoskeag	"	16x24"	"	28	7
176	"	1858	"	"	28	7
177	"	"	"	"	28	7
178	"	"	"	"	28	7
179	"	"	"	"	28	7
180	"	"	"	"	28	7
181	"	———	———	———	—	—
182	"	———	———	———	—	—
183	———	———	———	———	—	—
184	———	———	———	———	—	—
185	———	———	———	———	—	—
186	———	———	———	———	—	—
187	Peto & Co.	1857	16x20"	60"	25	12
188	"	"	"	"	25	12
189	"	"	"	"	25	12
190	"	"	"	"	25	12
191	"	"	17x22"	"	26	16
192	"	"	"	"	26	16
193	"	"	"	"	26	16
194	"	"	"	"	26	16
195	Hamilton Works	"	15x21"	66"	29	16
196	"	"	"	"	29	16
197	"	1858	15½x21"	"	29	16
198	"	"	"	"	29	16
199	"	"	"	"	29	16
200	"	"	"	"	29	16
201	"	"	"	60"	29	16
202	"	"	"	"	29	16
203	Ontario Foundry	1857	16x22"	56"	24	2
204	"	1858	"	"	24	2
205	"	1859	16x24"	60"	24	2
206	"	"	"	"	24	2
207	"	"	16x20"	66"	24	2
208	"	"	"	"	24	2
209	Grand Trunk Ry.	"	"	60"	29	0

The following extracts from two of the early reports of the Grand Trunk Railway serve to illustrate the conditions while the road was in the making:

Grand Trunk Railway—First Annual Report, July 24, 1854.

"The amalgamation of July, 1853 included the St. Lawrence & Atlantic, the Atlantic & St. Lawrence, the Quebec & Richmond and the Toronto & Guelph Railways, all of which were under construction.

"The Portland line had been completed a few days before the amalgamation but was unfit for working, particularly the section between Sherbrooke and Island Pond, and the locomotive and carriage stock was equally deficient, but according to the terms of the amalgamation one train had to be run every day. This was done during the winter of 1853-4 with the greatest difficulty as there were no snow fences, the line was not ballasted in many sections and the old Company had used some sort of a metal cross-tie that was unsatisfactory.

"The amalgamated locomotive stock consisted of 34 engines of which 4 were scarcely worth repairing and most of the remaining re-

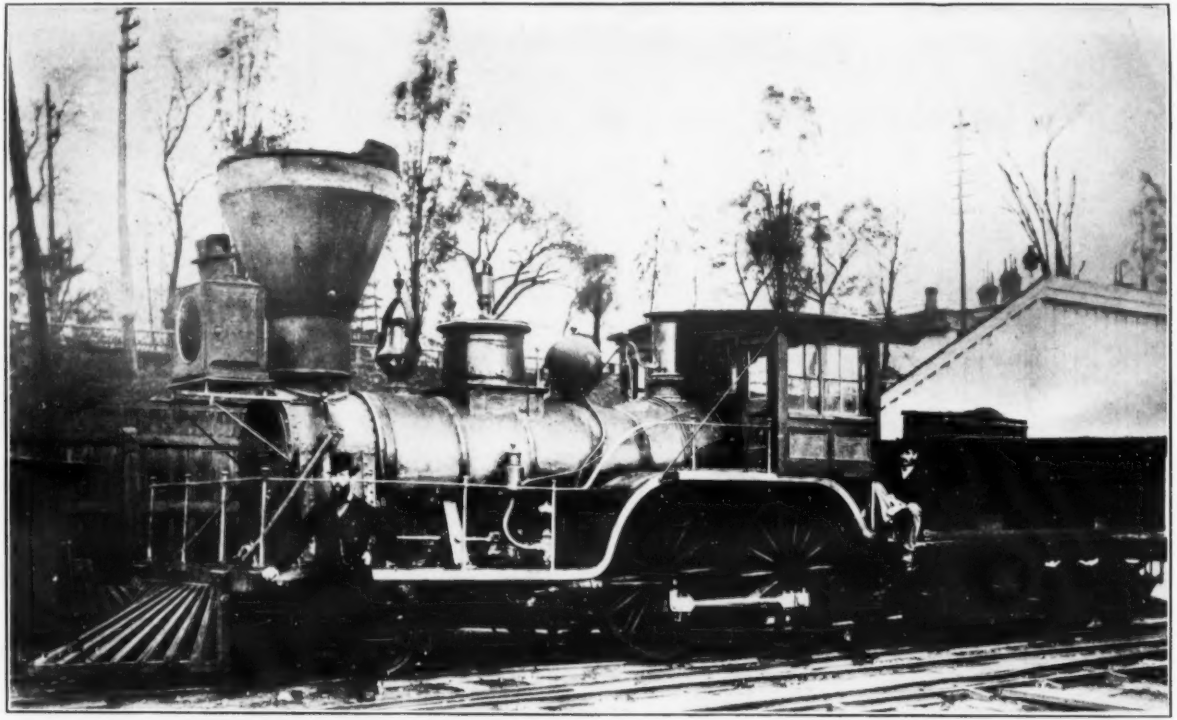


FIG. I

The "Lady Elgin," built by the Portland Locomotive Works in 1852 for the Ontario, Simcoe & Huron Railway, running from Toronto to Lake Simcoe and the northern townships, and eventually acquired by the Grand Trunk. The first locomotive in Ontario, and a fine type of the early Portlands. See reference to in Bulletin #10, Page 54.

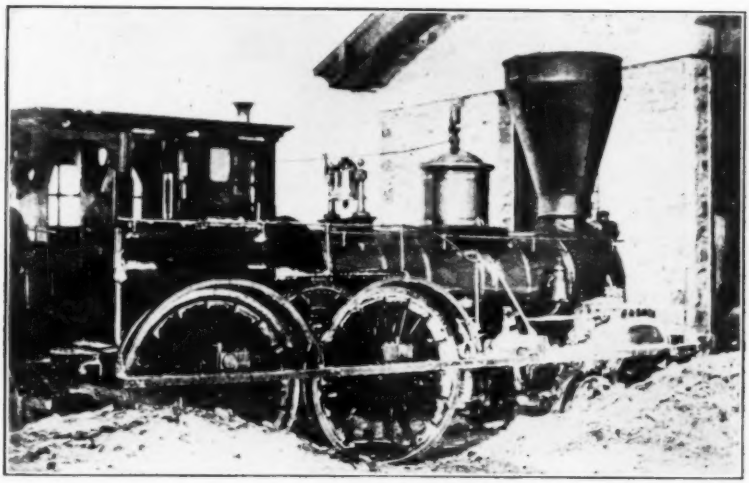


FIG. II

Engine No. 26, the second Portland with outside cylinders, and a replica of the "Berlin." It was built in 1854.

quired thorough repair. The Old Companies had also contracted for 25 additional which have since been delivered and the present (July 1854) stock of engines is 64.

"Locomotive power is being prepared in England at the Canada Works, Birkenhead where bridge iron-work for the Victoria Bridge is also constructing."

Grand Trunk Railway—Second Annual Report, 1855.

This report is very brief and there is little of interest in it.

Stone for the piers of the Victoria Bridge was being quarried at Pointe Claire for the northern half of the bridge and on the shores of Lake Champlain for the southern section and the contractors had just provided two powerful steam-boats for use in connection with this work.

The Quebec & Richmond section had been so much improved during the spring and early summer of 1855 that the express trains were able to run from Longueuil to South Quebec in five hours.

CANADA'S PIONEER LOCOMOTIVES

It may not be amiss to mention here two other railroad enterprises in Canada which affected the Grand Trunk Railway.

In July, 1851, the Champlain & St. Lawrence R. R. opened its extended line along the west bank of the Richelieu River, from St. Johns, Que., to Rouses Point, N. Y. This effected the first rail connection between St. Lambert, opposite Montreal, and Boston and New York. The road thereupon changed its name to Montreal & Champlain R. R.

In May, 1852, the Montreal & Lachine R. R. extended to Mooers Jct., N. Y. and thus effected connections with American points. This road became subsequently known as the Montreal & New York R. R.

In June, 1853, the St. Lawrence & Atlantic R. R. effected a junction with American lines and subsequently became a part of the Grand Trunk Ry. Thus we find three rival lines bidding for the transport trade to New York in 1853. All had to employ ferries to carry their freight and passengers over the St. Lawrence river at the three points—St. Lambert, Caughnawaga and Longueuil. Ferries were used in the open season while in winter they used horse drawn sleighs and stages to cross the ice. In early winter, when the ice was forming and in spring, when the ice was breaking up, passage became extremely hazardous and sometimes no crossing was made for days. In the mid-winter, during the severe cold weather, crossing the St. Lawrence was a trying ordeal.

In December, 1859, the Victoria Bridge, between Point St. Charles and St. Lambert, was opened for traffic and the fate of the two rival lines was sealed. They fell to the natural prey of the predominant corporation and were absorbed in 1863 when the Grand Trunk took over the Bonaventure Depot for its Montreal terminal.

Thus the Grand Trunk acquired its most picturesque and historic locomotives from these roads. From the Montreal & Champlain R. R. came the following:

"Montreal," known as "the little Montreal," Baldwin, 1846, inside cylinders 11x16", drivers 54" and weighed 10 tons. 4-4-0 type.

"Jason C. Pierce"—No data available. Supposed to have antedated the "Montreal." Named after the chief promotor of the first railroad in Canada, who was an American, later a resident of St. John, P. Q.

"John Molson"—a Kinmond of 1847. An engine of the 2-2-2 type, later rebuilt to a 4-2-2. Built in Dundee and weighed 16 tons. No other data to be had at present.

Four engines of the 4-4-0 type were built by the Taunton Locomotive Works, Taunton, Mass.

"St. Lambert"—Oct. 30, 1851, 14x20" 66"

"St. Helen"—Apr. 4, 1852, 14x20" 66"

"Dorchester"—May 29, 1852, 16x20" 66"

"La Prairie"—Aug. 31, 1852, 16x20" 66"

All were inside connected and weighed from 20 to 22 tons.

Other engines have been described to us, too; engines with high single drivers that used to do the sixty odd miles from Rouses Point to St. Lambert in fast time. No record of these is obtainable.

CANADA'S FIRST LOCOMOTIVE

On the Champlain & St. Lawrence R. R. was the "Dorchester," Canada's first locomotive, a Stephenson built in 1853, 0-4-0 type of 6½ tons, later built to the 2-4-2 type. There was also the first "Laprairie," a Norris engine built in 1838, 4-2-0 type of 8½ tons. Both of these engines were sold to the Lanoraie & Industrie R. R., (Joliette, P. Q.) in 1849.

From the Montreal & New York R. R. came the "Montreal," known as "the big Montreal." Built by Kinmond, Scotland, of 16 tons, 2-2-2 type, later rebuilt to the 4-2-2 type. No other details at hand.

"James Ferrier," a replica of the "Montreal" and built in Scotland. No details.

Amoskeag furnished the "New York," "Canada," "Caughnawaga" and "Souhegan" in 1852. All 4-4-0 type and of 20 tons. Only the first two engines are shown on the Amoskeag list.

"Hemmingford," a Hinkley of 1852, 4-4-0 type and of 16 tons. No details.

We have heard old Grand Trunk men describe these gaudy and brassy red-wheelers of the Molson and Ferrier lines, especially the decorated Kinmonds in the days when they were an attraction at the Mountain Street crossing, going in and coming out of the Bonaventure Depot. It was here that one of them, the "Hemmingford," one summer day in 1873 blew up and killed her driver, Patrick Kelly.

Were we fully informed we could fill a volume portraying and describing them, the most picturesque of all the Canadian locomotives.

FIRST ENGINE BUILT BY THE GRAND TRUNK—1859

We have dwelt at no little length on the early engines of this road because we feel that the members of this Society are more deeply interested in their history.

The story of the Grand Trunk locomotives may be divided into four sections: 1848-1859, the latter date being the date the road built its first

locomotive: 1859-1873, when the Company changed its gauge; 1873-1896, when President Charles M. Hays eliminated the diamond stack and from 1896-1923, when the road was merged into the Canadian National System.

In May, 1859, the Grand Trunk Railway produced its first engine, No. 209, named the "Trevithick" after F. H. Trevithick the first Mechanical Superintendent of the Company. Mr. F. H. Trevithick was a nephew of the famous Richard Trevithick, who built and operated the first practical locomotive to run on rails at Merthyr Tydvil, Wales, in 1804. The "Trevithick" was of the standard 4-4-0 type, weighed 29.0 tons with outside cylinders of 16x20" and 60" drivers. (See Fig. XI) The engine resembled a Kinmond and, like the latter, was based in its design upon the best features of contemporary practice. The working pressure was 120 lbs.

The "Trevithick" was the first of a series of excellent engines that were especially serviceable in freight haulage. They showed the influence of Allen's practice in the Birkenheads by their spread driving wheels. (See Fig. XII). Like the Kinmonds, they were a combination of English and American ideas and these were manifest and striking. The American influence predominated. The small signal lamps in lieu of the big headlight, were after the English style; also the sand-box placed by the driving wheels. It was the same way with the Birkenheads and with many other of the Grand Trunk engines until after Mr. Trevithick's retirement.

In 1863, Mr. Trevithick relinquished charge of the Grand Trunk Shops and returned to his ancestral home in Cornwall, England. His place was taken by Richard Eaton who came from the Great Western Railway Shops at Hamilton, Ontario. He introduced steel into the manufacture of locomotive boilers having used this material at the Hamilton Works in 1861. Mr. Eaton at once applied his ideas to the design of the Grand Trunk engines. One of his features, which characterized nearly all the engines built by the Company up to 1896, was the straight topped boiler with the flush fire box outer shell inside of the wagon-top type of usual practice. Otherwise Mr. Eaton's locomotives followed American lines displaying Rhode Island domes and regular headlights. Their cylinders were uniformly 16x26" (outside connected), the freight engines with 60" drivers, the passenger engines with 66" drivers, the average weight about 65,000 lbs. and working pressure 135 lbs.

During Mr. Eaton's tenure of office, many engines were delivered to the Grand Trunk Railway by American and Canadian builders. Fig. XIII is a fine example. In 1868 twenty-five engines of the 4-4-0 type were delivered by Neilson & Co., Glasgow, Scotland. These engines averaged in weight 32 tons, had 16x26" outside cylinders and 61" drivers. They had diamond stacks somewhat flattened on top. They were designed to burn coal.

The coloring of the Company's engines at this period was varied—reddish brown and bottle green or plain black. At this time the mushroom stack came into favor and was to be seen in its diversified forms as often as the more impressive funnel.

Mr. Eaton retired in December, 1872. On January 1, 1873, he was succeeded by Mr. Herbert Wallis. It was in 1873 that the Grand Trunk Railway changed the gauge of its tracks. That the 5'-6" gauge originated in Portland, Maine is an accepted fact. In Bulletin No. 18 will be found our version of its origin. It was, that the British military authorities fixed it at 5'-6" so as to differentiate the Canadian railroad system from the American so that in case of war, the engines and rolling stock of an American invading army could not be used. That this was the attitude of the Imperial authorities is an established fact.

At the same time the suggestion of a wider gauge than standard was welcomed by the engineers of the Atlantic & St. Lawrence R. R. because of the greater scope it afforded to the fire-box and gearing of the locomotives, thus obtaining greater steadiness for both engines and trains. I have before me a booklet entitled—"Report on the Gauge," by A. C. Morton, Esq., Portland, 1847, for which I am indebted to a fellow member, Mr. Thomas W. Streeter of New York. It is a lengthy and elaborate argument addressed to Mr. A. N. Morin, President of the St. Lawrence & Atlantic Ry., giving the fullest exposition of the advantages to be gained from a gauge of 5'-6" and a convincing plea for its adoption by the Canadian division of the new railroad. The impression given is that it was the Americans and not the Canadians who desired to have the broad gauge. We submit that the idea emanated from the minds of the military men and so entered the minds of the railroad engineers, who, in the forties were not satisfied with the restrictive narrow gauge and took the opportunity to put into effect the wider gauge they so ardently desired.

THE CHANGE TO STANDARD GAUGE

For years the Grand Trunk Railway had been feeling the ill effects and inconvenience of being of a different gauge than the American trunk lines. Necessary expedients were resorted to in order that the Grand Trunk equipment might fit itself to the American lines. Sliding or movable wheels on one axle, which by the removal of a pin and a graduated track would change the gauge; also a third rail to permit American equipment to pass over certain sections of the line such as that of the Central Vermont Railway from Rouses Point to Montreal via Victoria Bridge.

These changeable devices for the car wheels, always unsafe and insecure, increased the cost of maintenance and led to many costly wrecks, especially in freight service. At successive annual meetings it was recommended that standard gauge be adopted but the proposition was so vast as to discourage the directors and cause its indefinite postponement. In the meantime, with the steady increase of traffic and the extension of the various lines, the problem became most acute until finally, in 1873, the Grand Trunk Railway decided to standardize its main lines. During the two days of October 3rd and 4th, having made systematic preparations in advance to expedite the work, the task was completed from Portland to Port Sarnia, a distance of one thousand miles by rail.

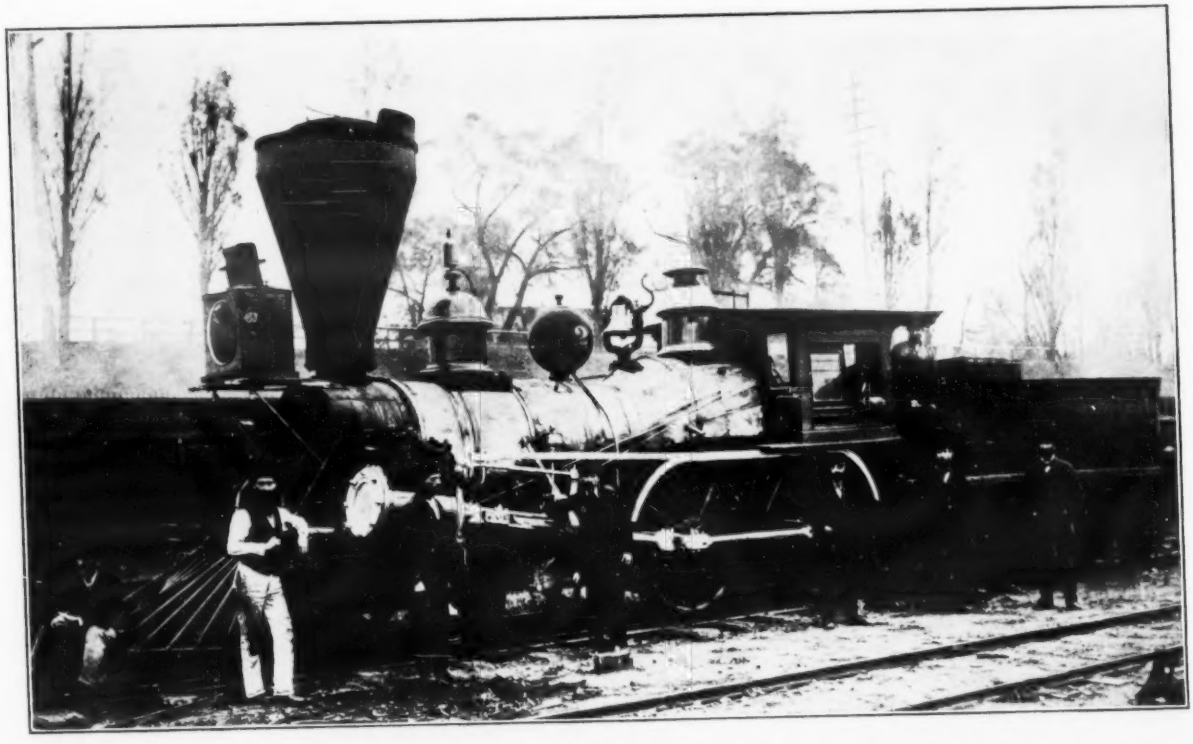


FIG. III

The "Toronto." First locomotive built in Canada. Built by James Good in his machine shops, Sherbourne Street, Toronto, during the spring and summer of 1853. Drive-wheels, 5'-6", gauge, 5'-6", weight, 24 tons.

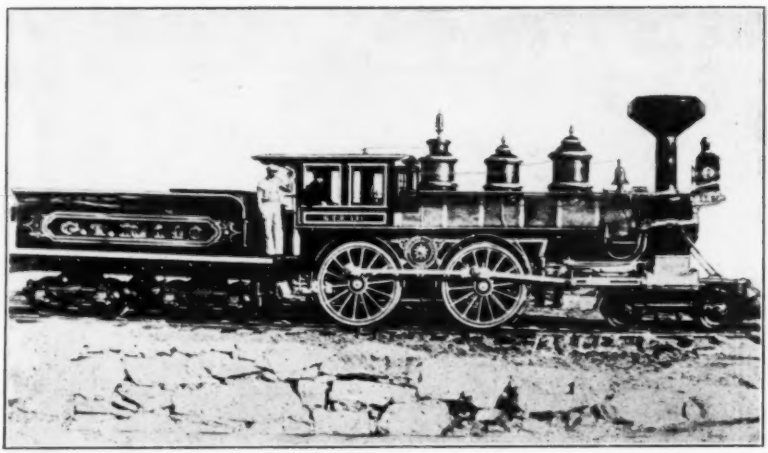


FIG. IV

G. T. R. engine, No. 110, built at the Portland Works in 1870

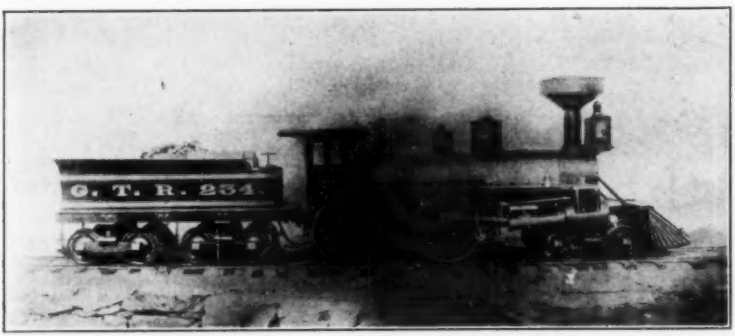


FIG. V

G. T. R. Engine No. 234. A Portland of the later 50's as rebuilt at the change of gauge in 1873.

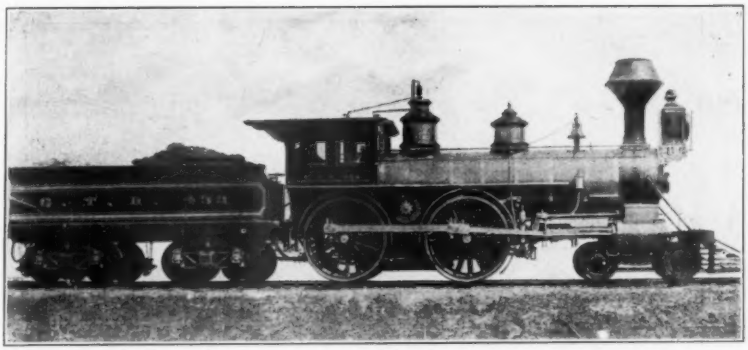


FIG. VI
G. T. R. Engine No. 432. Built at the Portland Works in 1875.

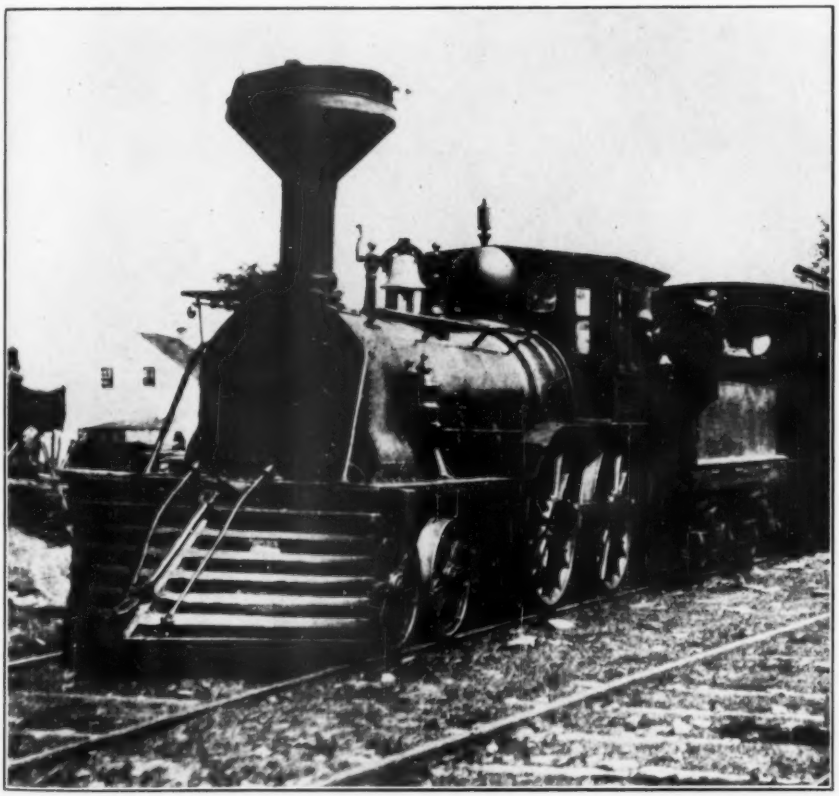


FIG. VII
The "Carillon," built in 1854 for the Montreal & By-town Railway, afterwards the Carillon & Grenville. A typical Kinmond. See Mr. Robt. R. Brown's article in Bulletin No. 22, page 40.

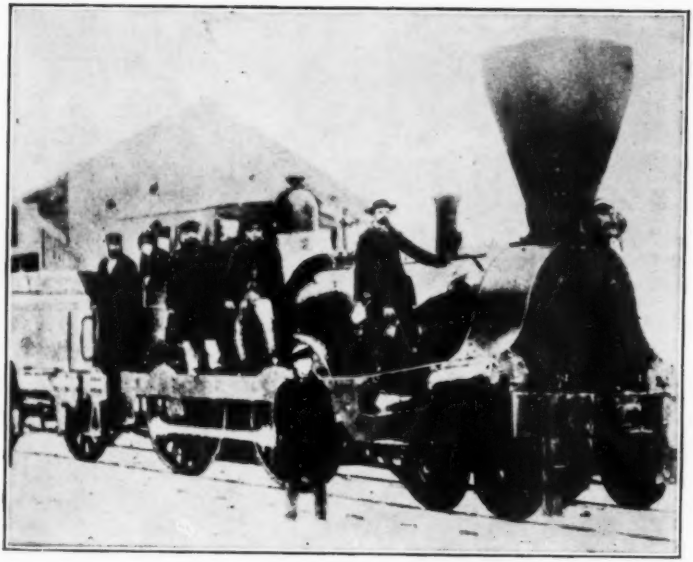


FIG. VIII

G. T. R. Engine No. 60. Built in Birkenhead, England, in 1855. One of the earlier type.

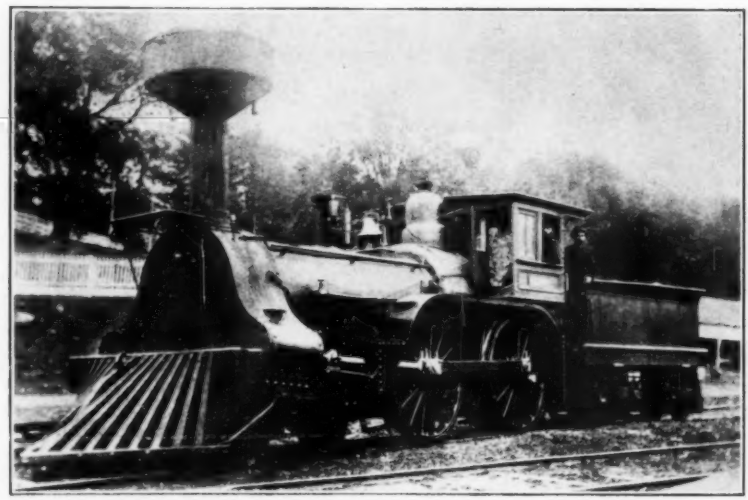


FIG. IX

The more refined type of Birkenhead, as exemplified in the "Ottawa" of the Carillon & Grenville Railway. This locomotive was purchased from the Grand Trunk in 1856 or '57.

Fig. X

HERBERT A. PANGBORN

Son of Geo. W. Pangborn, who was the first engine-driver in British North America. Mr. Pangborn, now in his 87th year, resides in Rockland, Ont. He worked on the construction of the Victoria Bridge, 1858-9, was machinist and engine-driver, Champlain & St. Lawrence R. R., to 1862. Was steam-boat engineer on the Mississippi in the Civil War in the operations before Vicksburg, 1863. Was engine-driver on the Chicago & Rock Island to 1867. Was engine-driver on the Grand Trunk, 1868 to 1881, when he became first Mechanical Superintendent of the Canada Atlantic Railway. Later became passenger conductor on the Grand Trunk, retiring in 1914.

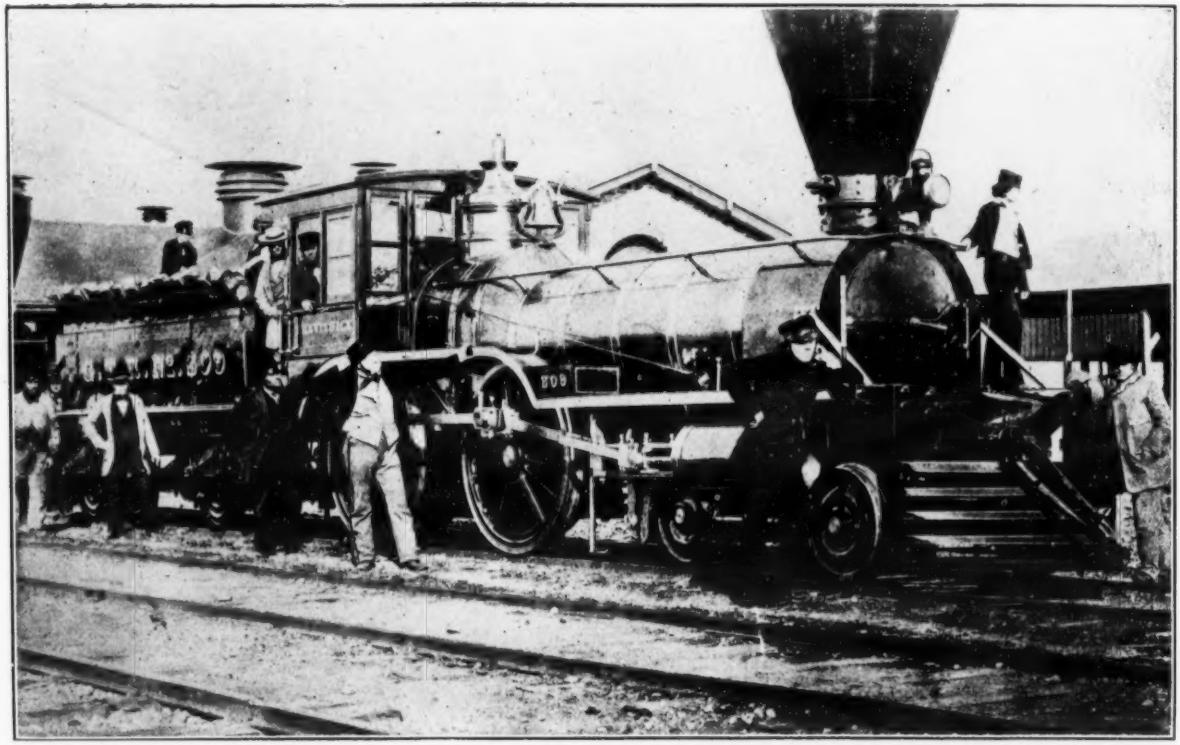


FIG. XI

G. T. R. Engine No. 209, the "Trevithick," the first locomotive built in the Company's own shops, 1859. It was assigned to haul the special train that bore the Prince of Wales, later Edward VII, on his tour of Canada in 1860, when he came to officially open the Victoria Bridge. Trevithick is shown in light vest and trousers, resting his left hand on the running-board at the drive-wheels.

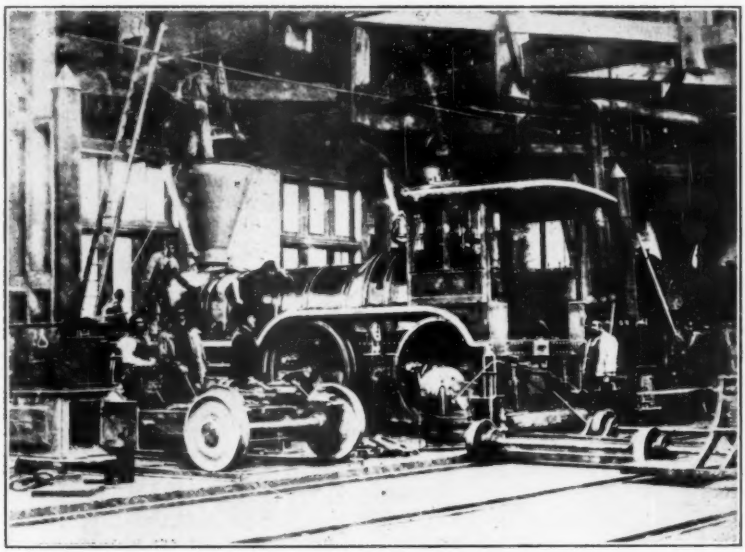


FIG. XII

The "Trevithick" in course of erection, G. T. R. Shops, Point St. Charles, Montreal, 1859. Trevithick is the central figure looking up to the workmen adjusting the boiler lagging.

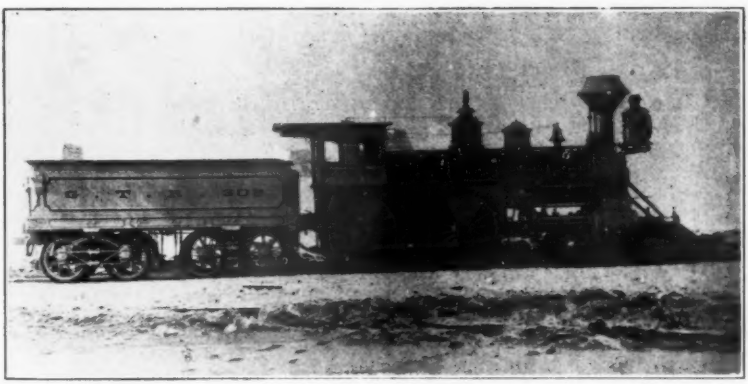


FIG. XIV

A typical product of the Point St. Charles Shops in the 70's, Engine No. 302. Note the pipe of vacuum brake into stack.

...bore the Prince of Wales, later Edward VII, on his tour of Canada in 1860, when he came to officially open the Victoria Bridge. Trevithick is shown in light vest and trousers, resting his left hand on the running-board at the drive-wheels.

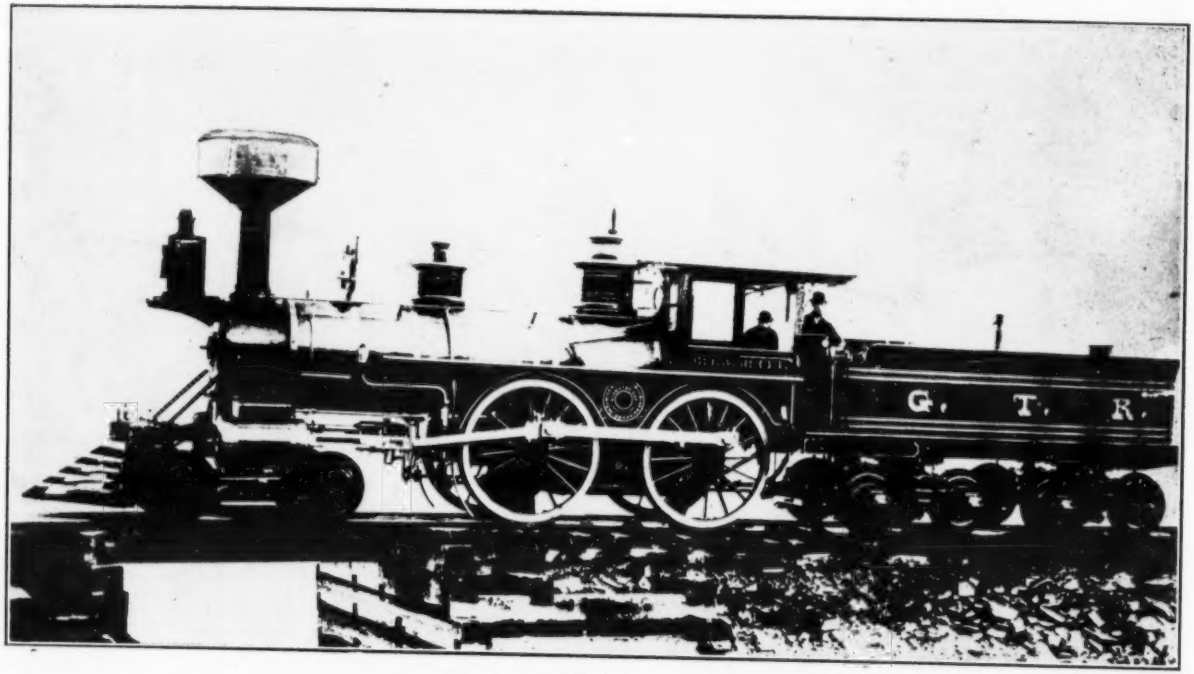


FIG. XIII

G. T. R. Engine No. 233. Built by the Canadian Engine & Machinery Works, Kingston, Ont., 1870.

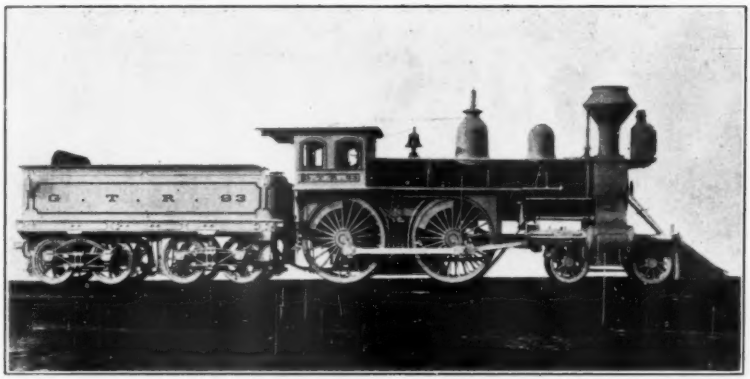


FIG. XV

A triumph of 1881. G. T. R. Engine No. 93, built at the Point St. Charles Shops. Note vacuum brake pipe leading into diamond stack.

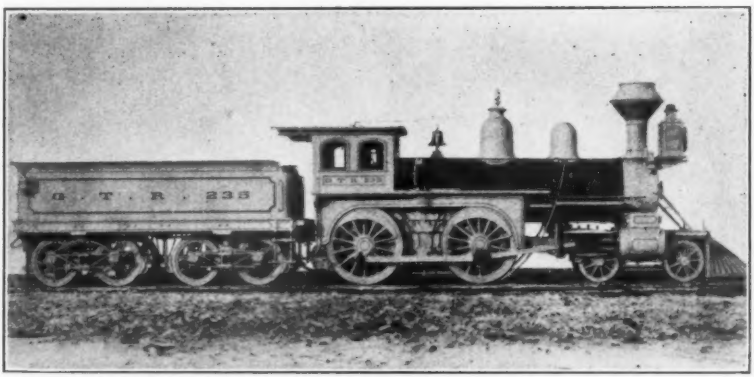


FIG. XVI

A serviceable type, Engine No. 235, built at Point St. Charles in 1882.

FIG. XVII

A typical Grand Trunk express engine of the -80's. This one has undergone some changes from its original appearance. The square boxed headlight has been replaced by a later style. The original stack was slightly tapered with a moulded rim at the top, as shown in Fig. 19. The cowcatcher, too, is of more recent design. Its colour is bottle green.

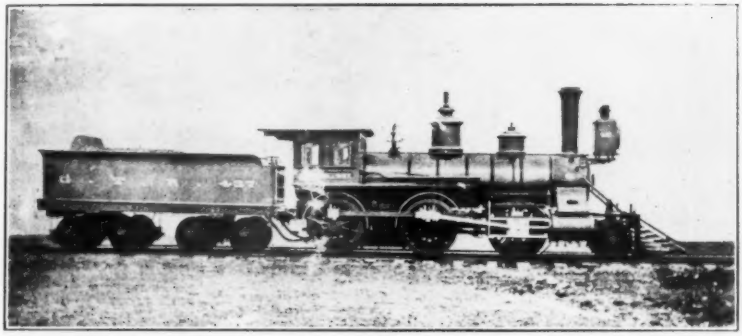


FIG. XVIII

G. T. R. Engine No. 437. An interesting type of mogul which appeared in 1884. These engines were painted a dark red with brown ribs on the boiler, and brown lettering and numbers picked out in gold. It was built at Point St. Charles.

FIG. XIX

A typical suburban tank engine of the 80's. This engine served on the Montreal-Lachine run for many years.

been replaced by a later style. The original stack was slightly tapered with a moulded rim at the top, as shown in Fig. 19. The cowcatcher, too, is of more recent design. Its colour is bottle green.

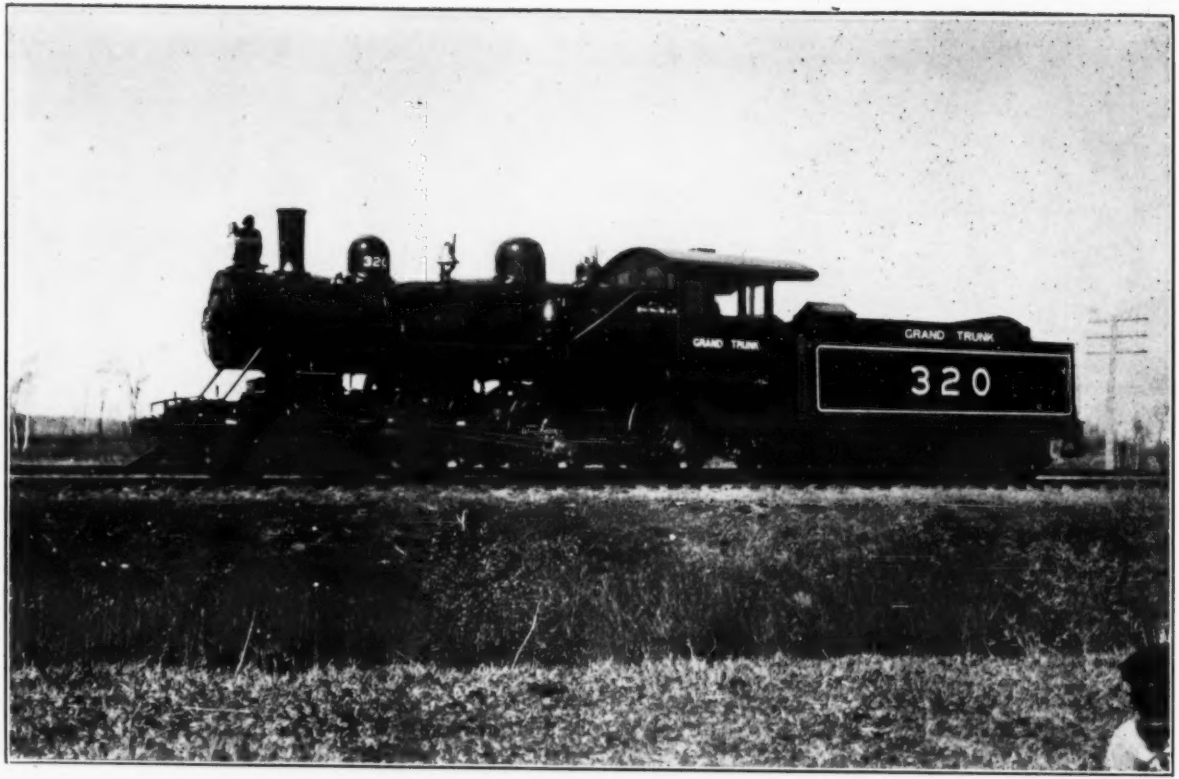


FIG. XX
A. G. T. R. passenger engine of 1903. Built at Point St. Charles.

FIG. XX
A. G. T. R. passenger engine of 1903. Built at Point St. Charles.

FIG. XXI
A Grand Trunk passenger engine of 1911, a type which was adopted by the Company in 1905. This engine was built at Point St. Charles.

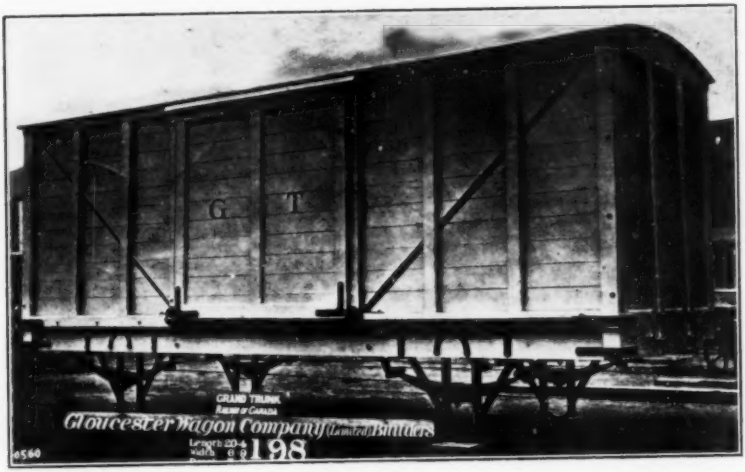
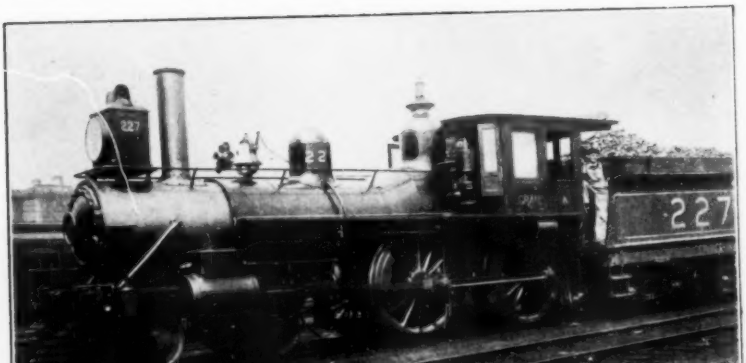


FIG. XXII

An early English-built 'van' for the G. T. R.



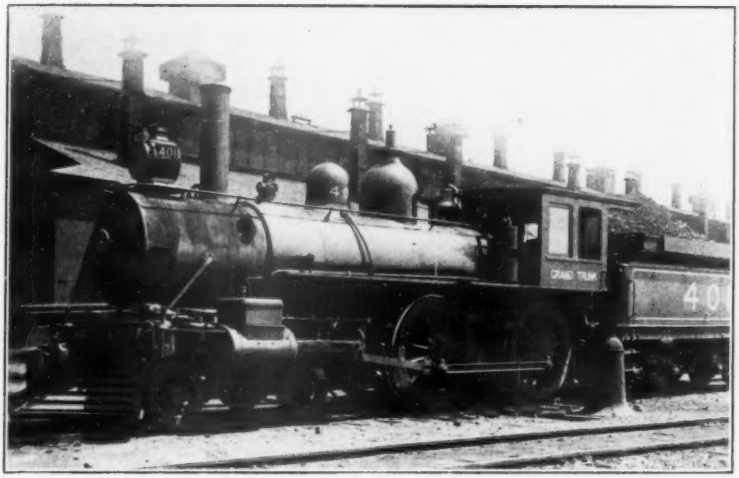


FIG. XXIV

G. T. R. #401 eight-wheel passenger of straight boiler type. Kingston 1887.

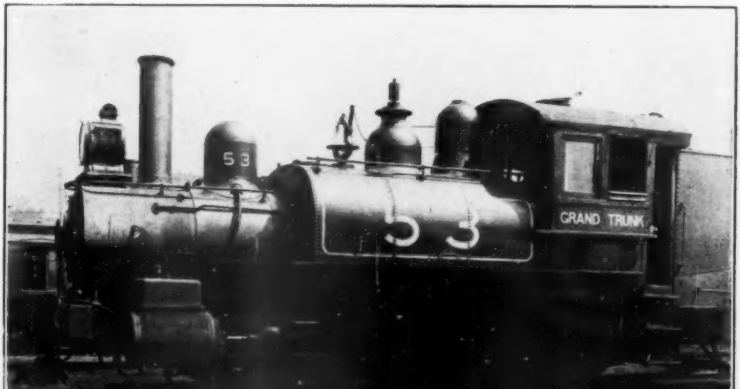


FIG. XXIII

G. T. R. #227 eight wheel passenger of wagon-top boiler type. Schenectady 1873.

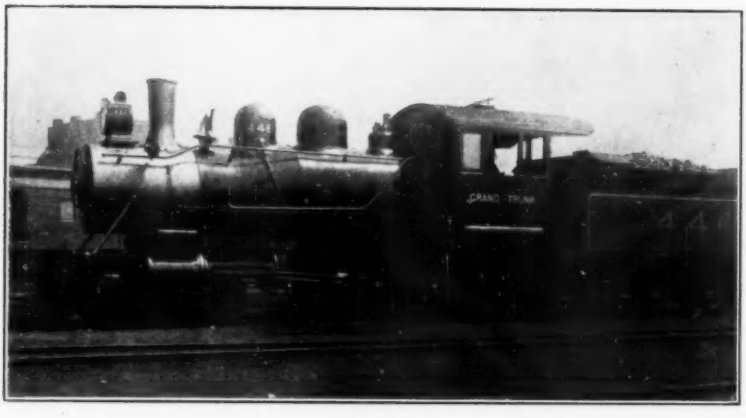


FIG. XXVI

G. T. R. #446 showing final stage of rebuilding of this class

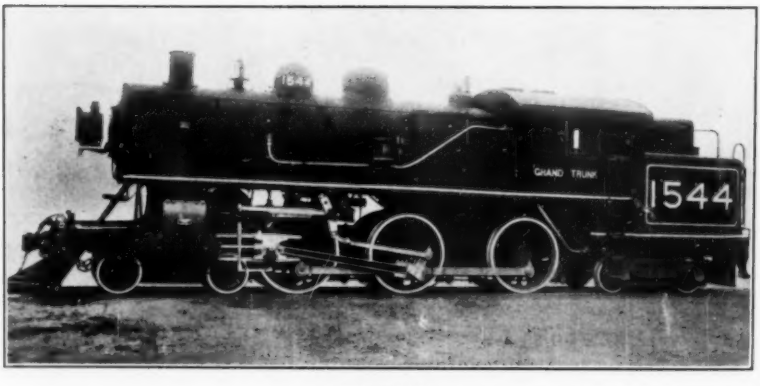


FIG. XXVII

G. T. R. #1544 a suburban type engine. Montreal Works 1914.

FIG. XXV

G. T. R. #53. An early switcher showing the English saddle tank.

A NEW GENERATION OF ENGINES

In order that the line should be adequately equipped after the change of gauge, 160 locomotives of the standard 4-4-0 type were imported from the United States and made ready to commence operation of the line after the 48 hour interruption. These included 60 locomotives from the Manchester Works, 45 from Baldwin, 20 from Schenectady, 15 from Rhode Island and 20 from the Portland Works (See Fig. VI). The Kingston Works and the Grand Trunk shops provided about 20 each and 135 of the old broad gauge engines were rebuilt to suit the new conditions. (See Fig. V). The new engines averaged in weight 70,000 lbs., had 17x24″ cylinders and in nearly every instance carried 140 lbs. pressure. The passenger engines had 66″ drivers and the freight engines 60″. These engines marked the coming of the coal-burner and the diamond stack and the passing of the wood-burner and the funnel.

The Grand Trunk locomotives of the seventies invariably bore the moulded Rhode Island dome and sand box. (See Fig. XIV). In the early eighties, Mr. Wallis introduced a new design with graceful smooth domes, a feature that characterized all subsequent Grand Trunk locomotives up to 1896. In 1881 a high wheeled passenger engine appeared with 78″ drivers. (See Fig. XV). It was a magnificent engine, capable of high speed, but like all high wheelers, it found it difficult to start a heavy train or make the grades. A more serviceable type of engine, with 68″ drivers, was built the following year and these were general in passenger service. (See Fig. XVI).

The color scheme of these engines was in deep maroon and light brick-red with black lines. Like the Birkenheads, the boiler lagging, cylinder casing, dome jackets, the drivers and truck wheels, the cab and tender, were thusly painted. The letters and numbers on the tender, cab and headlight were in black. The engine of 1881 was equipped with the vacuum brake. The engine of 1882 carried the Westinghouse air brake. From 1876 to 1881 the vacuum brake had been used successfully on the Grand Trunk passenger trains, but as the mechanism did not conform to the air brake used on American equipment, it was abandoned in 1882. The working pressure of the engines of 1881 and 1882 was 160 lbs.

In 1883 the straight stack appeared with the elongated smoke chamber upon which was placed the headlight. (See Fig. XVII). In some instances we find engines with short smoke chambers, Rhode Island domes, projecting headlights and straight stacks as shown in Fig. XVIII. In this case, it would seem as though the diamond stack had been supplanted. This engine, a mogul freight, represents a type first used on the Grand Trunk in 1874. Up to 1896 about 170 of these engines had been built at the Grand Trunk Shops.

THE PASSING OF THE DIAMOND STACK

Mr. Wallis, while he was in charge of the motive power, produced many fine locomotives. There were light passenger engines of 70,000 lbs., heavy express engines of 100,000 lbs., with drivers ranging from 68″ to 72″. He also produced light moguls in the seventies, heavy moguls in

the nineties, simple and compound, weighing 112,000 lbs. Yard and suburban tank engines were either built or converted. (See Fig. XIX). In his twenty-three years of service he evolved a high class practice in the Grand Trunk Shops. He retired in 1896 and was succeeded by F. W. Morse.

It should be mentioned that throughout the term of Mr. Wallis, as well as that of Mr. Morse, the Grand Trunk Railway continued to purchase locomotives from both American and Canadian builders. Some of the American engines were built to Grand Trunk specifications, others were to builder's plans. Among the latter were a number of saddle-top boilers with smooth domes. Some were painted brick-red and others were black and iron.

In 1896 Charles M. Hayes became General Manager of the Grand Trunk Railway. Mr. Hayes began a war against the time honored diamond stacks, so familiar at the terminal points and along the line. Within three years they had disappeared. Mr. Morse began to build larger locomotives, quite in contrast to the low-backed engines of his predecessor. In his express engines, see Fig. XX, we find the weight increased to 180,000 lbs. and the working pressure increased to 200 lbs. Under his regime the 4-4-0 type passed out of practice on the Grand Trunk although several fine eight wheelers were built in 1898, which were the last built by the Grand Trunk.

Mr. Morse concentrated his efforts upon the development of the ten-wheel express engine and the mogul freight compound. Many fine, powerful engines of these types were produced. In 1904 he brought out his single expansion consolidation type locomotive. In 1905 he produced a handsome 4-6-2, Pacific type passenger locomotive. (See Fig. XXI). These were the standard passenger engines at the time the road was acquired by the Canadian Government. He also built heavy 0-6-0 switching engines and in 1912 produced a heavy 2-8-2, Mikado type, for freight service. His color scheme was a dark bottle green with white lettering and numerals, a radical change from the maroon and brick-red.

Thus it was that in 1923, when the Grand Trunk Railway was merged into the Canadian National Railways, the motive power had been thoroughly modernized and practically every engine ante-dating 1896 had passed into oblivion.

ENGINES OF ACQUIRED LINES

Many more pages would be required to enumerate and describe all the locomotives that the Grand Trunk Railway assimilated. Many and varied were the engines of the Great Western Ry. which was acquired in 1882 while those of the Midland; the Ontario, Simcoe & Huron; the Canada Atlantic and the lesser lines here and there in Ontario and Quebec form a historic section of their own.

Old railroad men about Ottawa and Montreal will doubtless remember three beautiful Baldwin engines that came to the Canada Atlantic some thirty years ago. They were the first "Atlantic" type engines seen in Canada, probably, and bore the numbers 618, 619 and 620. The latter two were delivered in May, 1899. They had 78" drivers and 13x22"

cylinders. The former, the 618, was delivered in May, 1901. This engine had 84¼" drivers, 13½x23" cylinders and weighed 168,910 lbs. without the tender. Shortly after the arrival of the 618, the engine was assigned to haul a special train bearing Mr. Charles M. Hays, the late President of the Grand Trunk Ry. The trip was made, as we recall, from Montreal to points in Ontario and return. Over the last section on the return journey, from Coteau Landing to Point St. Charles, a distance of about fifty-five miles, this engine attained a speed of almost 104 miles an hour. This is supposed to be the Canadian high speed record for locomotives.

Then there were the colorful engines of the Central Vermont with their vermilion wheels, brass mountings and all bravely decked out in green and gold. These engines with their straight red smoke-stacks which they assumed in the '80's, are still remembered by those, who like the writer, were schoolboys then.

And so, let us end our story of the wood-burners, the diamond-stacks and the stately engines of a later day. We can still see them, in their long romantic line—The Locomotives of the Grand Trunk Railway of Canada.

The author's thanks is due to Mr. W. F. Connal, Mechanical Engineer of the Canadian National Railways for several of the accompanying illustrations and for other information. To Mr. Robert R. Brown for obtaining the list of locomotives for 1859 and assistance in compiling other lists. To Mr. C. W. McMullen for the photograph of the "Josephine" and to Mr. Arthur Curran for the illustrations covered by Figs. XXII to XXVIII. Figures I, III, IV, V, VI, VII and VIII have appeared in previous bulletins.

Mr. Loye has given us the names of the men that appear in the illustrations of the "Lady Elgin" and "Toronto". In the illustration of the "Lady Elgin," standing on or near the cow-catcher is John Harvie, first Conductor of the line. Sitting on the tender step is W. H. Adamson. In the "Toronto," on the cow-catcher is W. H. Adamson, leaning on the cow-catcher is John Broughton, before the cylinder is Joseph Benson, leaning on the piston guide is Daniel Sheehy and by the rear driver is James Armitage. In the cab window is Joshua Metzler. Standing on the tender is James Phillips. At the front of the tender is John Harvie, at the middle of the tender is Charles Storey and at the end of the tender stands Thomas Peters. These photographs were taken about 1886 when the engines were about to be broken up and after the line they had served had been acquired by the Grand Trunk Railway.

THE MOCCASIN TRAIN

For many years on the Grand Trunk the train running from Cornwall and Coteau Landing district to Montreal was known as the Moccasin Train.

Tooh.....Tooh....at night in the rain,
Plaint is her whistle, the Moccasin train.
The habitant hears in his cottage the cry
Of the Moccasin train drawing near to—
—Vaudreuil.
Choom....choom....as soft the rain falls,
Husky the frog in the marsh hollow calls.
The semiphore lamp in a halo that burns
Like a ruby aglow to an emerald turns.

Tingh....tingh....the engine bell tolls,
Thundering over the culvert it rolls.
Now seen in the mist like a glittering chain,
As she creeps in the darkness, the old Moccasin train.

JOHN LOYE.

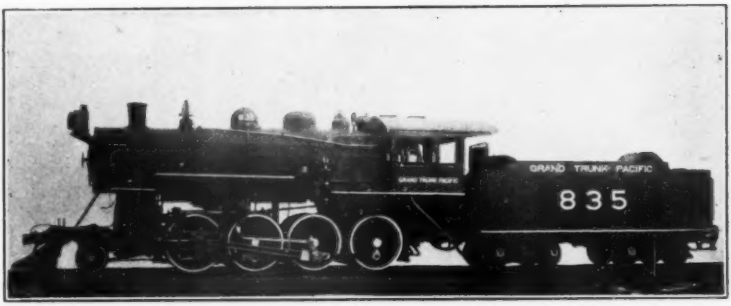


FIG. XXVIII

G. T. R. #835, a standard consolidation of the G. T. R. Kingston 1912.

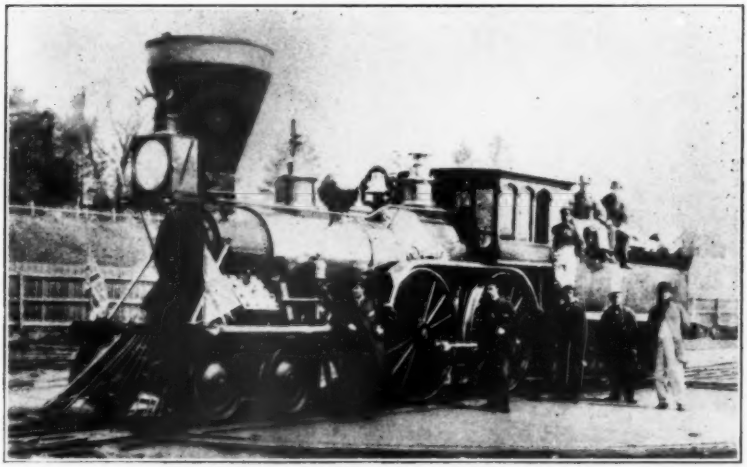
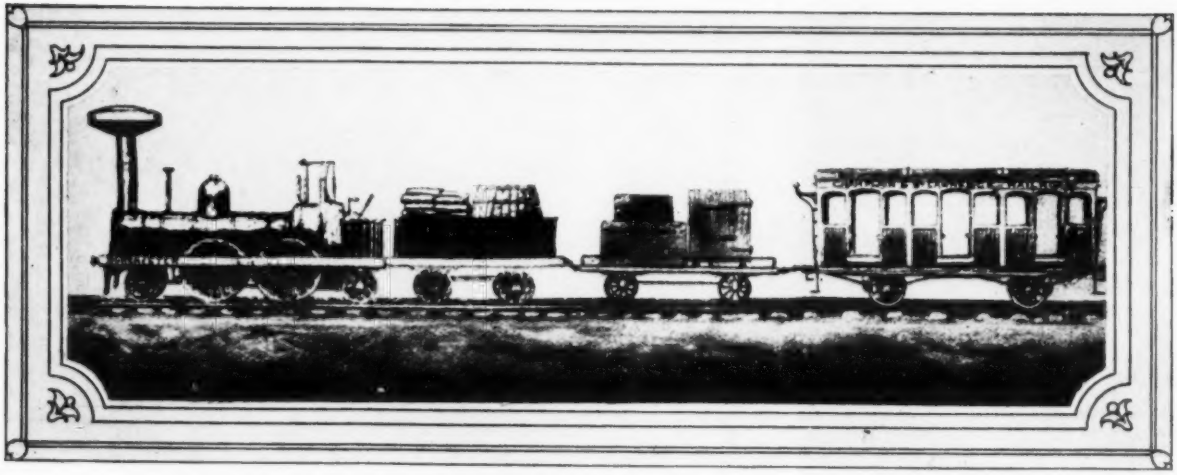


FIG. XXIX

THE FAMOUS JOSEPHINE

The finest and fastest engine of her day in Upper Canada, and No. 3 of her line, the Ontario, Simcoe & Huron Railway. Built by the New Jersey Locomotive Works, Paterson, N. J., 1853.

Reproduced by the courtesy of Mr. C. W. McMullen, from the collection of his private museum, 95 Pembroke Street, Toronto.



FIRST TRAIN IN CANADA
Drawn by John Loye from sketches by Alex. Walmsley. First published in the Montreal Daily Herald, Aug. 1903.

Editor:

In view of the appearance in Bulletin 23 of the illustration, "First railroad train in Canada," in connection with the article by Mr. Breithaupt on the development of the Grand Trunk Railway of Canada, and showing the locomotive, "Dorchester," with a 2-4-2 wheel arrangement, I feel called upon to explain the origin of this now well known picture, and the reason for depicting the engine in so peculiar and unseemly a fashion.

In March, 1902, I first read of the dimensions of the engine, as quoted by the late Herbert Wallis from Whishaw's "Railways of Great Britain and Ireland," 1840. It was described as being of 6½ tons, with two pair of coupled drive-wheels 48 inches diameter. As no picture of the engine was then known of, I decided to reproduce it from the aforesaid description as a 0-4-0 coupled "Planet" type. I consulted with the late Alex. Walmsley, of St. Johns, P. Q., a veteran of the Champlain & St. Lawrence Railroad, to obtain, if possible, the more intimate details.

Mr. Walmsley, then in his 78th year, made pen and ink drawings of the locomotive and cars. From these I made the drawing as here reproduced.

This picture has gone all over the world. I have the original sketches made by Walmsley, with those I made therefrom and so depicted, and which I hope to reproduce in a future number of the Bulletin.

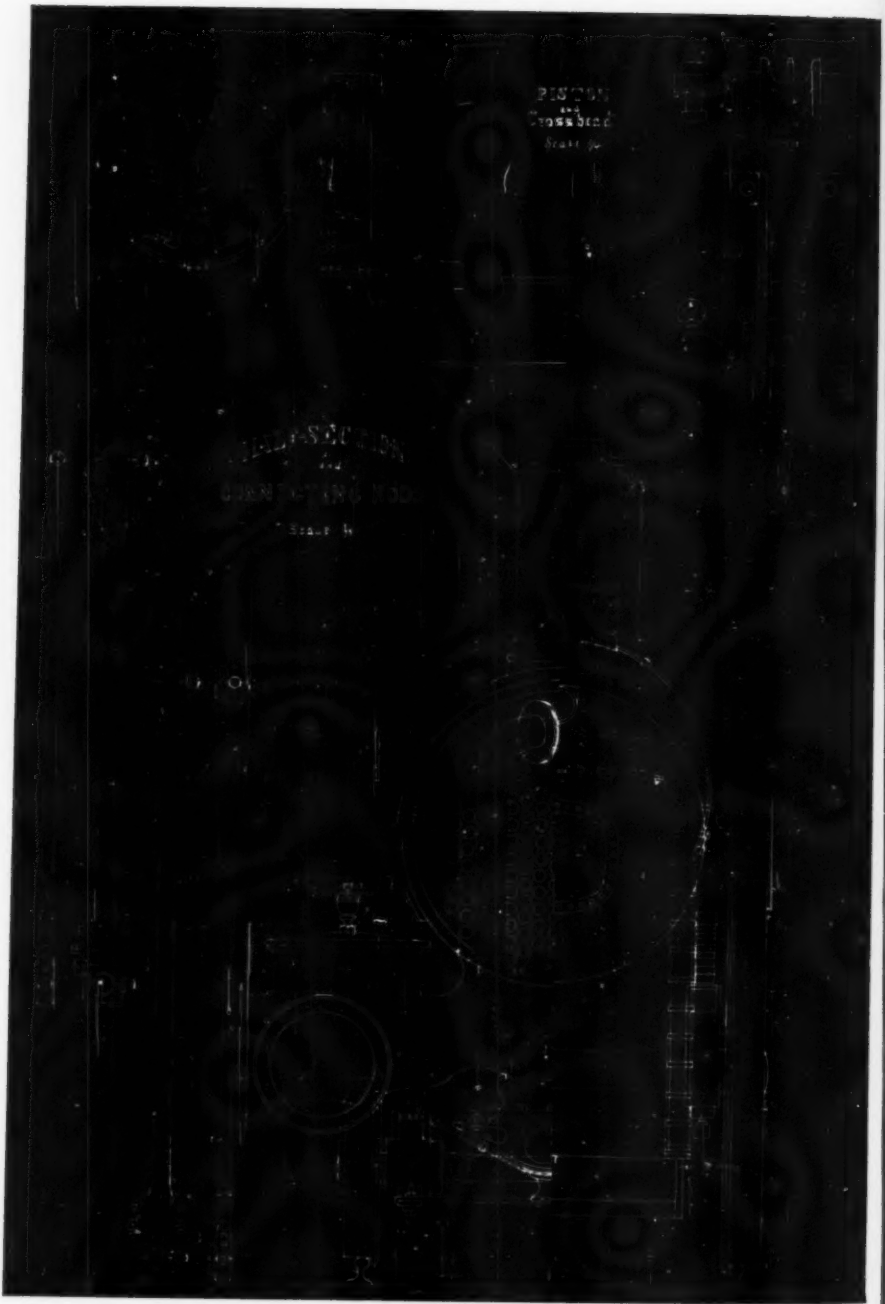
That I ever so monstrously depicted the little Dorchester is one of my life's regrets. Subsequent inquiries have shown that the engine was in its original arrangement an 0-4-0 coupled Planet. In this I have the positive assurances of Robt. Stephenson & Co., Darlington, Eng., its makers, and Messrs C. F. Dendy Marshal and J. G. H. Warren, both noted authorities on early English locomotive construction.

Shortly after the appearance of my drawing in the Herald, a Montreal newspaper, in August, 1903, the late Chas. T. Hart, a well known antiquarian of Montreal, informed me that the engine, as he remembered, was almost exactly the same as the "Pioneer," of the Chicago & Nor. Western, a Baldwin 4-2-0 type of 1836. This statement was later confirmed by the testimony of others who recalled the engine, and also by the bringing to light in 1927 of the gold watch which belonged to Geo. W. Pangborn, first engineer of the Dorchester, and upon which is engraved an engine of the same type as the Pioneer.

The engraving bears no confirmatory name. On the inner case there is an inscription telling of its presentation to Geo. W. Pangborn by fellow employees of the Champlain & St. Lawrence in 1852. It is at present in possession of E. J. W. Pangborn, Colton, California, grandson of the former owner, and he has assured me that the cut is that of the Dorchester.

This would indicate that the engine was rebuilt from an 0-4-0 Planet into a 2-4-0 Baldwin. When this was done remains to be definitely determined, but the main fact is established.

In a future issue of the Bulletin we hope to illustrate more fully the story of the Dorchester, but trust that for the time being the foregoing will suffice to explain the origin of the idea that the engine ever was a 2-4-2, as is so often stated. Yours truly, JOHN LOYE.



BOSTON, HARTFORD & ERIE R. R. NO. 21

Review of Locomotive "No. 21" on the Boston, Hartford & Erie Railroad

By Thomas Appleton

INTRODUCTION

THE locomotive engine, as its name indicates, is an engine capable of locomotion, propelling not only its own weight but also that of passengers or freight placed in suitable cars attached to it.

The possibility of constructing steam carriages had been suggested by Watt in his early investigations on the properties and applications of steam, and in 1782 Oliver Evans, of Philadelphia, patented a steam wagon, the drawings and specifications of which were sent to England in 1787 and again in 1794. A locomotive carriage was also patented in 1784 by Watt; and a non-condensing working model was constructed the same year by his assistant, William Murdock. In 1802 Richard Trevithick patented a high pressure engine, and in 1804 constructed one for the Merthyr Tydfil Railway in South Wales. Lightly loaded it did very well upon a level surface or light grade; but more severely tasked the wheels would slip around without advancing. This slipping of the wheels, which was thought to be an inherent and insurmountable difficulty, put a check upon the use of locomotives until they devised some means by which they could obtain a hold upon the track or otherwise push themselves along. A rack was laid beside the rail into which worked a toothed wheel fitted to the engine. This was tried on a colliery line near Leeds, but the friction was found to be too great and it was abandoned. The next year engines with eight driving wheels were used to secure the required adhesion, and about the same time steam engines were constructd with levers projecting behind and working alternately like the legs of a horse. In 1814 and 1815 engines with plain wheels were found to work successfully on some of the northern roads but no other application was made of them than transporting the coal and ore wagons of the mines. The first railroad opened for carrying passengers was the Stockton and Darlington Road in 1825 and this was worked with horse power. The French engineer, Mr. Seguin, in 1826 successfully introduced locomotives on several French railways. And in these engines he first constructed small tubes running from the firebox to the chimney, an arrangement of the greatest importance for increasing the evaporative power of the engine and which was adopted by Messrs. Stephenson and Booth in their engines. He also increased the draught of the fire by means of a ventilator, an effect which Robert Stephenson better accomplished in 1829 by the use of the exhaust steam. A premium of £500 was offered by the Liverpool and Manchester railway in 1829 for the best engine—one that should not produce smoke, should draw three times its own weight at the rate of ten miles per hour, be supported on springs, not weigh more than six tons, or four and a-half tons if sup-

ported on four wheels only, and not to cost more than £550. In October, 1829, four locomotives were presented for trial, and the prize was awarded to the "Rocket", weighing four tons, five cwt., built by Messrs. Stephenson and Booth, which ran at an average speed of 14 miles per hour, with a gross load of 17 tons, and under certain circumstances doubled this speed. The next year steam carriages were in regular operation on this road. The small engine that determined the question of their use soon gave place to more powerful machines till some of those employed on the modern roads have attained a weight of 48 and even 60 tons, having 6, 8 or 12 coupled wheels.

One of the engines built by George Stephenson at his works at Newcastle on Tyne arrived in New York in the spring of 1829, and was to be seen for some time at the yard of E. Dunscomt, in Water Street, its wheels raised from the ground and kept running for the gratification of those interested. Another engine built by Foster, Rastrick and Co., of Stourbridge, England, arrived soon after, and was put upon the road from the coal mines on the Delaware and Hudson Canal Co. in the summer of 1829. This was the first use of a locomotive in this country. It was an engine on four wheels furnished with a multitubular boiler and exhaust blast.

It is a noteworthy fact that before the use of locomotives was established in Great Britain, or they were known in the United States, the Directors of the railroad from Charleston to Hamburg, S. C., determined, under the advice of their engineer, Mr. Horatio Allen, as given in his communication to the Board in November, 1829, to make them exclusively the motive power.

The first American locomotive was planned by Mr. E. L. Miller, residing at Charleston, S. C., constructed by the Kembles at their shop in New York, and placed on the Charleston and Hamburgh road late in the summer of 1830. It was a small four-wheeled engine, having an upright boiler with water tubes near the bottom. Upon this road in 1831 was first introduced on any railroad, either in the United States or abroad, the important arrangement of two four-wheeled trucks for locomotives and long cars. These were built from plans designed by Mr. Horatio Allen in 1830; and with no essential change his system of double truck running gear has ever since been adopted on all the roads of this country.

The "Rocket" as built by Stephenson in 1829 contained many of the leading elements of the locomotives of the present day. The firebox surrounded by a water space, the multitubular horizontal boiler, and the draught caused by the exhaust steam are all used in every modern locomotive. Allen early introduced the four-wheeled truck, as before mentioned. This by its turning upon a center pin accommodates itself to a curve, the axles assuming radial positions. This admits the use of long frames on roads having curves of short radius.

The amount a locomotive can draw is limited by the friction between the driving wheels and the rails. This friction is in direct proportion to the weight sustained by the wheels. By increasing the length of the driving-wheel base, more weight is made available for friction. Some

locomotives are constructed without the use of truck wheels, so that the entire weight rests upon drivers. In these engines however the rigid position necessary for the driving wheels renders the resistance excessive. The fuel and water supply for the locomotive is generally carried on a tender, a separate carriage with six or eight small wheels. This tender is necessarily a part of every train, it carries no freight, nor is any of its weight available for traction; hence the tender and its burden are always dead weight. Whoever makes this dead weight available for traction, or reduces it in any other way, adds to the efficiency of the locomotive. The best locomotive should have all its weight, including that of fuel and water, available for traction, and be capable of generating sufficient steam to just slip the wheels on a dry rail. A locomotive on these principles has been devised by Mr. Fairlie, an English engineer. It may be called a double engine, having four cylinders and two smoke stacks. The boiler is best described by comparing it to two ordinary locomotive boilers united at their rear ends, the fuel being supplied through a door in the side. This, with its long firebox and two sets of tubes of moderate length, gives a large amount of heating surface where the combustion is most intense, with a strong draught,—an excellent boiler. The machine is supported upon the swivelling truck, or "bogies," having four or six wheels each; the wheels of each truck are coupled and acted upon by two cylinders, each pair of cylinders receiving steam through the hollow centre pin and exhausting by a similar channel into its respective smoke-stack. The fuel and water are placed in suitable receptacles along the side of the boiler and resting upon the frame of the engine. This bids fair to rank as the greatest improvement in locomotive construction since the days of Stephenson.

The railroads of our large and rapidly growing country form an item of great, nay vital, interest in our political economy. Our immense natural resources must be developed for the prosperity of the nation. The coal for our foundries, manufactories and dwellings must be transported from the mines and distributed among a widely scattered people. The iron from distant mines must be conveyed to meet the coal. Grain and cattle must be transported to feed our crowded cities. Raw materials must be taken to the factories and refineries, and the products of manufacture carried to markets. And what means of transportation at once so speedy, sure and economical as the railroad? But the locomotive furnishes the power for all this transportation; without this motor the traffic would be reduced to a small fraction of what it now is. Its only competitors are the horse, either on canals, railways or common roads; the stationary engine, drawing cars by means of ropes; and the atmosphere as used in the tubular railway. The universal use of steam railways conclusively proves that the locomotive has distanced all rivals and maintains its high position as indispensable to the welfare of a civilized nation. Its great beauty of form and of operation, as well as its great capability of locomotion excite the highest admiration of every thoughtful observer.

The construction of locomotives is a great and increasing business. Paterson and Jersey City, N. J., Schenectady, N. Y., Taunton and

Boston, Mass., and Providence, R. I., are the seats of large and well established locomotive works.

Wood and coal are both used as fuel in locomotives. In thickly wooded sections, distant from coal mines, the former will be preferred. The relative economy of the two classes of fuel at a given place may be ascertained by experiment. The fluctuations in price are often sufficient to induce railroad managers to alter their engines from coal to wood burners and vice-versa. For freight service on heavy gradients a large and powerful engine with small drivers, say 4½ or 5 feet high, should be chosen. For passenger service the wheels may be higher and generally the engine is lighter. The locomotive under review, being employed on long route freight service with grades of 53 and even 60 feet to the mile, is admirably adapted to the purpose, as will be shown by the

GENERAL DESCRIPTION

The locomotive under review is classified as an "outside-connected, coal burning freight engine." It weighs in working order 67,400 lbs., or nearly 34 tons. The cylinders are 16″ diameter and 24″ stroke. The firebox is 60″ X 36″ on the grate and 60″ high, fitted for burning bituminous coal. Barrel of boiler 46″ diameter with 136 wrought iron tubes 2″ exterior diameter and 11′ long. The drivers, 4 in number, are 5 feet high. The peculiarities in the construction of this engine are; the conical swell of the boiler over the firebox; the longitudinal seams of the boiler, consisting of a lap joint with a bent welt inside having three lines of rivets; the tubular stays of the firebox admitting air above the fire for more perfect combustion; and the self-acting or steam piston packing.

The engine was built in the spring of 1867 at the Taunton Locomotive Works, Taunton, Mass., of which P. I. Perrin, Esq., is Superintendent. It was purchased by the Boston, Hartford and Erie Railroad Co. for $12,500 in the summer of 1867 and placed upon the short route passenger service on the Boston end of the road, where it worked for a long time with great economy; afterwards a lighter engine was substituted for it and the "No. 21" was placed on the long route freight service, doing good duty with heavy trains. At the present time the locomotive may be truthfully said to be in as good condition as when it left the shop, and from the simplicity of its machinery and the excellency of the workmanship it bids fair to endure more than the ordinary "life" of a locomotive.

DESCRIPTION OF PARTS

I. For generating and conducting the steam.

The Boiler is 16′ 8″ long over all; the cylindrical portion or barrel is 46″ in diameter; the sheets are arranged telescopically, each successive ring being placed outside of the one before; this construction allows the water to be entirely withdrawn from the barrel when blowing off. The third sheet from the forward end is made in a conical form at the top, the rear end of it being 6″ higher than the front, while the horizontal diameter remains the same. The portion to the rear of this and

over the crown sheet is level and all 6″ higher than the barrel. Twenty-eight and one-half inches from the rear end is placed the dome, 25″ internal diameter and 27″ high. The joint with the top of the boiler is strengthened by two large plates running about one-fourth way around the inside of the dome, bent to fit the top of the boiler. The shell is much weakened by the 25″ hole for the dome and these plates reinforce it sufficiently to guard against transverse rupture at that point. The firebox is surrounded by a 3″ water jacket; the bottom of this water space is formed of a rectangular frame of wrought iron 3″ x 2″ in section with holes drilled for rivets passing through it and both plates. The oval fire door, 14″ x 16″, is placed 3′ 2″ from the bottom, the aperture being strengthened by an oval piece of iron placed between the sheets and riveted through. The crown sheet is slightly arched in cross-section, and stayed by 12 wrought iron bars 5″ x 5/8″ running longitudinally; these stay bars are arranged in pairs, each couple being welded together at the ends but separated 7/8″ throughout their length to allow bolts to pass between them; the bolts are placed at intervals of 4¾″, passing through the crown sheet, with a nut on each end, a washer being placed between the bars and the crown sheet. Six stays run from these stay bars up into the inside of the dome and are fastened to its sides. The sides of the firebox are stayed by 7/8″ iron screwed and riveted. There are 6 long 1½″ stay rods running from the back end of the boiler to the forward sheet. The tubes, 136 in number of wrought iron, 2″ external diameter and 11′ long, being "upset" at the ends to secure the tube sheets against bulging outward. The grate bars are of cast iron and can be dumped by means of a lever in the cab. The main steam pipe is 4¾″ in diameter inside, made of copper; it rises within the dome 32″ above the ordinary water level, where it is covered by an ordinary sliding throttle valve. The steam enters through two rectangular ports, 1″ x 6″. There are two ordinary spring balance lever safety valves with 3″ openings. The slide valves are of the ordinary construction, the end of the valve stem being made in the form of a hollow rectangle embracing the top of the valve. This construction allows a little vertical play, which is necessary on account of the vibration of the back shaft and the wearing of the face of the valve. Each valve is worked by two eccentrics keyed to the forward driving axle; the eccentrics and straps are both of cast iron. Wrought iron bars connect the straps with either end of curved links operating the lower arm of the rock shaft, which reverses the direction of the motion, the eccentric working ahead while the valve moves back. Between the upper arm of the rock shaft and the valve is the valve stem made in two parts joined by a long nut with a "right" and "left" screw to adjust the position of the valve. An Ashcroft steam gauge is used. Three gauge cocks are placed at distances of 3″, 6″ and 9″ above the crown sheet. The smokestack is of a form much used in New England, having a wide netting and curved deflection to arrest the sparks drawn through by the exhaust. The engine is supplied with several exhaust nozzles from 3″ to 4½″ diameter at the orifice, terminating 20″ below the center of the boiler. Water is supplied to the boiler by two plunger pumps worked directly from the crosshead.

II. For generating and transmitting power.

The cylinders are cast with projections on the upper and inner sides for the purpose of attaching the steam chest and pipes and also securing the cylinders to the frame of the engine. Each one is bolted to the frame and to a large casting running across under the smoke arch, to which it is firmly secured. This casting rests upon the center of the truck frame, which thus supports the entire weight of the forward end of the engine. The piston has a self-acting steam packing. Its construction is quite simple, as will be shown by the detailed drawings. A cast iron ring with a groove of Babbitt metal is placed in the center. This ring is turned 1/32″ smaller than the cylinder, and is provided with set screws to expand it when worn. This ring takes the wear of the friction when the steam is not employed. On each side of the aforesaid ring is a narrow ring of cast iron, which is kept steam tight against the inside of the cylinder by the pressure of the steam itself, small holes being made in the follower plates for the admission of steam below them. The friction of the piston is thus greatly reduced, for the pressure upon the inside of the cylinder is never more than just sufficient to keep the piston steam tight, however small the steam pressure may be; and when the steam does not act the only pressure to produce friction is that due to the weight of the piston itself. The means adopted are much simpler than the old spring packing and at the same time cannot be injuriously used by setting out the packing too tightly. The piston rod is of steel 2¾″ diameter, keyed to the crosshead. The piston is secured to the rod by being "shrunk" on. The crosshead is of cast iron, the wings running between the guides are perforated with plugs of Babbitt metal to reduce the friction. The guide bars are of steel, made deepest in the center where the strain from the connecting rod is the greatest. The connecting rod of wrought iron, rectangular in cross-section, is made larger at the crank-pin end than at the other, and has a true taper throughout its length. The parallel rod, likewise of wrought iron, is of similar section but of the same size throughout. Both these connecting rods have brass boxes, enclosed by a wrought iron strap, at each end; the ends of the rods being enlarged to receive the bolts and keys. The crank pins are of steel. The driving wheels, five feet high, are of cast iron, hollow spokes and rims with Krupp's steel tires. The truck wheels are of cast iron with chilled faces, 28″ high and 5′ 2″ between centers. These dimensions allow the cylinders to be placed on a level with the center of the driving wheels, as they should be. One of the truck wheels runs near each end of the cylinder. The cab is handsome and roomy, the necessary levers and valves being conveniently placed for use without being cramped so as to be inaccessible for cleaning or repairs.

TABLE OF DATA

Firebox 60″x36″ on the grate and 60″ high inside
Water jacket 3″ inside
Outside sheets ⅜″ thick
Flue sheets ½″ thick. "Low moor" iron
Inside sheets 5/16″ thick. "Low moor" iron

Rivets ¾" diam., 1⅞" apart
Stays in firebox ⅞" diam., 4½" apart
136 iron tubes, 2" external diam., ⅛" thick, 11' long
Dome 25" diam., 27" high
Main steam pipe—vertical part of cast iron, 4¾" diam.; horizontal portion of copper ⅛" thick and 4¾" diam. inside.
Branch steam pipes of cast iron, 4½" diam. inside
Blast nozzle 4" diam. at orifice
Exhaust pipe 6" diam.
Smokestack 14" internal diam., 5' 3½" high
Netting 48" diameter
Stay bars over crown sheet 5"x⅝" and 60" long
Stay rods 1¼" diameter
Cylinders 16" diam. 24" stroke. Total length 32"
Bolts for cylinder heads, 8 in number, ⅞" diam.
Safety valves, 2 in number, 3" diam.
Arms of lever 3½" and 42"
Throttle valve has 2 ports, 1"x6" with play of 1¼"
Slide valves 8"x17". Travel in full gear 4½"
Steam ports ⅞"x15"
Exhaust ports 2"x15"
Connecting rods 3⅛" x 1¾" at small end; 3⅝" x 1¾" at other end; 6' 8" long from center to center
Straps 1¼" x 1¾". Bolts ⅞".
Parallel rods 3⅛" x 1¾" and 7' 6" from center to center
Straps and bolts same as above.
Crank pin 3½" diam. in main rod boxes
Crank pin 3" diam. in parallel rod boxes
Pin in crosshead 3" diam.
Piston rod 2¾" diam.
Cast iron drivers 55½" diam.
Tires Krupps' steel, 2¼" thick
Eccentrics 12" diam. 4½" throw
Radius of link 4' 6"
Pump plunger 1¾" diam., 24" stroke
Supply pipe 3" diam.

COMPUTATIONS

1. Strength of parts.

Stays of firebox water spaces

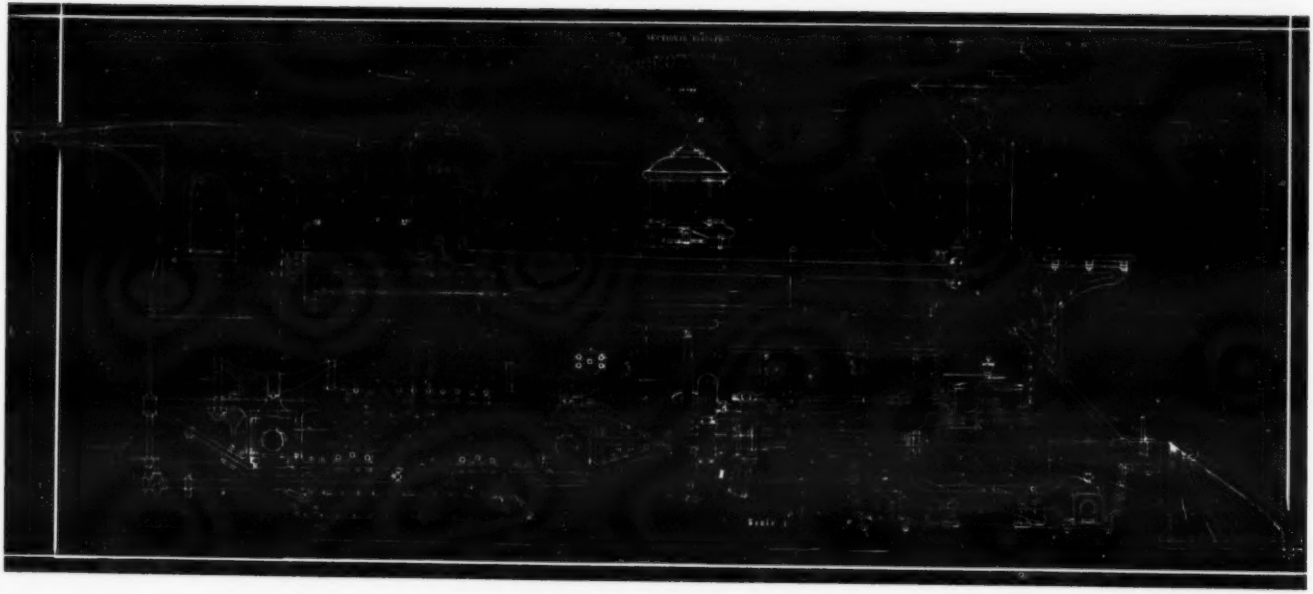
Molesworth gives the following dimensions for crown plate and stays screwed and riveted:—plate ⅜" thick, stays ¾" diam. 5" apart, bursting pressure 1110 lbs. per sq. in. The actual dimensions are:—plate ⅜" thick, stays ⅞" diam. 4½" apart, actual pressure 130 lbs. per sq. in.

Stay bars for crown sheet

The pressure upon the crown sheet at 130 lbs per sq. in. is 265200 lbs. This is sustained by 6 pairs of bars each 5" x ⅝" and 60" long. Substituting in the formula $L=\frac{24BD^2}{S}$ from Molesworth, the values $B=⅝$, $D=5$, $S=60$. We find for a working load with a modulus of 6, 75 tons or 178000 lbs. The center bars are supported in two places by bars running up into the dome and this with the curved form of crown sheet will give for the breaking strain, 3,136,000 lbs.

Transverse rupture of boiler

Rivets ¾" diam. 1⅞" apart. In circle 46.5" diam. there will be 78 rivets.



BOSTON, HARTFORD & ERIE R. R. No. 21

Area of rivets to be sheared—.4417x78—34.4526x50000=1,722,630 lbs.

Circumference of circle 46.5″ diam.=146.0844
Less holes for 78 rivets ¾″ diam. = 58.5
Solid plate= 87.5844

Area of plate to be torn=87.5844 x .38=33.2820 x 51000=1697382 lbs.

Throttle valve

Steam enters through two ports each 1″ x 6″ giving total area of 12 sq. in.

Steam pipe

Main pipe 4¾″ diam. Has area of 17.72 sq. in.
Branch pipes 4½″ diam. Have each an area of 15.9 sq. in.

Steam ports

Each steam port being 15″ x ⅞″ has an area of 13.125 sq. in.
The exhaust port being 15″ x 2″ has an area of 30 sq. in.
The exhaust pipe 6″ diam. has 28.27 sq. in. area.
The nozzle 4″ diam. has 12.56 sq. in. in area.

Safety valve

The opening of the safety valve, 3″ diam. is obstructed by the wings of the valve so that the area of steam passage is 7.068—1.316=5.752 sq. in.

Connecting rods

1st. Suppose the main connecting rod to be of the same size throughout, and the dimensions that of the smallest section. Then taking the formula for columns with $W=\frac{fA}{1+4C(\frac{L}{D^2})}$ and substitute the values:
$f=36000$
$C=\frac{1}{3000}$
$A=\frac{175''}{32}$ $L=77.25''$ and $D=3\frac{1}{8}''$ and we have W.
W=194337 lbs.
2nd. Suppose the rod to be of the same size throughout as it is at the larger end, and substitute in the same formula the values: $f=36000$; $C=\frac{1}{3000}$; $A=\frac{203''}{32}$; $L=77.25''$ and $D=3\frac{5}{8}$ and we obtain W—211328 lbs. The mean of these two values is 202833 lbs., which we consider the breaking strain of the main connecting rod.

Parallel rods

Taking the formula for columns with flat ends, $W=\frac{fA}{1+C(\frac{L}{D})^2}$ and substituting the values:—$f=36000$; $C=\frac{1}{3000}$; $A=\frac{175''}{32}$; $L=88.5''$; $D=1\frac{3}{4}$ we obtain for the value of W=109618.6=breaking strain of parallel rod.

Crank pin

Taking the shearing resistance of steel = 84000 lbs. per sq. in. the crank pin having an area of 9.6211 sq. in. will sustain a breaking strain of 808172 lbs.

Piston rod

Substituting in the formula for columns with flat ends f = 90000; $c=\frac{1}{30000}$; A = 4.9067″; L—33; D—2.5 and we have W—414421 lbs.—breaking strain on piston rod.

Cylinders

The only mode of rupture likely to occur in the cylinders is rupture of the bolts. The nuts are made very deep thus obviating all danger of stripping. The effective section of the bolt ⅞″ diam., i. e. the area at the bottom of the thread, is .362101x8 (because there are 8 bolts) = 2.896808 x50000 = 144840 lbs. = breaking strength of bolts.

SUMMARY

I. Strength of Parts

Longitudinal rupture of boiler

Taking a section 30″ long in order to have an even number of rivets. The strength of the joint is 456600 lbs. Area of surface acted upon to produce rupture is 697.5″. This gives a bursting pressure of 654.6 lbs. per sq. in. The working pressure never exceeds 130 lbs. 654.6 ÷ 130 = 5.04

Modulus of safety = 5.04

Comparing this joint with ordinary riveted joints for the same size and length of boiler, we find the following bursting strains:—

Double riveted lap joint	336,514 lbs.
Double welt single riveted	394,425 lbs.
Double welt double riveted	490,420 lbs.

But in the latter joint the quality of tightness is sacrificed for strength. The rivets are necessarily placed 3⅝″ apart, too far to admit of caulking the seam. The joint used upon this boiler is hence superior to all others in use.

Transverse rupture of boiler

Strength of transverse seam = 1,722,630 lbs.
Area of circle 46.5″ diameter = 1698.23 sq. in.
Bursting pressure per sq. in. = 1001.5 lbs.
Dividing this by the actual pressure 130 lbs. per sq. in. we obtain for modulus of safety 7.7.

Stays for water space of firebox

If the stays were ¾″ diam. and placed 5″ apart, they would sustain a bursting pressure of 1110 lbs., giving a modulus of safety equal to 8. But on the contrary, the stays are ⅞″ diam. and 4½″ apart. This would increase the already large modulus.

Stays for crown sheet

The long stay bars over crown sheet will sustain a breaking weight of 1,068,000 lbs. of themselves and they are strengthened still further by arching the crown sheet and supporting the bars by stay rods from the dome. The actual pressure is 265,200 lbs. This will give a modulus of 6 without considering the additional strength mentioned.

Cylinder head bolts

The breaking strain of these bolts is 28,968 lbs. Area of cylinder = 201 sq. in. At 130 lbs. per sq. in. this will give a modulus of safety = 5.5.

Piston rod

Breaking strain of piston rod = 364,690 lbs. Dividing by 201 and again by 130 we have a modulus of safety 13.95.

Main connecting rod

This will sustain a breaking strain of 202,432 lbs. Considering the whole pressure of 130 lbs. on each square inch of the piston to be transmitted to it, we have a modulus of safety 7.76.

Parallel rod

The parallel rod will sustain a breaking strain of 109,619 lbs. Supposing the forward driving wheel to slip, and the whole piston pressure transmitted through the parallel rod to the rear driver, we have as a modulus of safety = 4.2. If the force of the piston is taken up equally by both pairs of drivers the modulus rises to 8.4.

Crank pin

The crank pin has a shearing resistance of 808,172 lbs. Dividing by the total piston pressure (201x130) we have for a modulus of safety = 31.

II. Mechanical Effect

When doing ordinary average duty, the quantity of water evaporated is 144 cubic feet per hour. The values of load, velocity, traction, etc., limited by the friction between the drivers and the rail are found to be:—

$W = 560$ $Y^h = 12$
$T = 5025.07$ $Me^u = 60301$
$H.P. = 151$

These values are for a grade of 53 feet per mile with average friction on rail.

It will be seen that the boiler power of the engine exceeds these limits, on referring to the calculations of average action, which give the following values:—

$Y^h = 19.3$ $W = 560$
$T = 4471$ $Me = 86155$
$H.P. = 230$

The best velocity of train is found to be $V^h = 13.864$
The best value of cut off is found to be $V^h = .65$

III. Suggested Improvements

It might well be called an assumption for a student to "suggest improvements" in work of practical mechanics of long experience: and indeed the near coincidence of theory and practice in this work leaves little open to criticism. Nevertheless, I would respectfully suggest the following alterations with a view to improvement:—

1. That the rivets on the longitudinal seams of the boiler be made ¾″ diameter on the center row and ⅝″ on the outer row instead of all 11/16″ diameter.

2. That the openings in the throttle valve should be made larger, at least equal in area to that of the main steam pipe. As constructed the throttle valve has an opening of 12 sq. in., the main steam pipe 17.72 sq. in. and the steam port of the cylinder 13.125 sq. in.

3. The spring balance safety valve, which has often been condemned by writers upon steam boilers, is in use on this engine, as it is on thousands of others. The term "safety valve" is a misnomer for this instrument, for with a brisk fire the steam pressure may be raised many pounds above the "blowing off point". The reason for it is, that the valve in rising increases the tension of the spring balance, and so instead of relieving the pressure it allows it to increase although the steam may be wheezing through the contracted orifice. A true safety valve when once open prevents any further increase in pressure, by allowing it free escape, and at the instant the pressure falls below the "blowing off point" it should close tightly. Such a valve is the one invented by Geo. W. Richardson, of Troy.

CONCLUSION

The engine under review is one of the ordinary make of the "Taunton Locomotive Manufacturing Company", one of the oldest locomotive firms in the country. W. W. Fairbanks, Esq., superintendent of the Grant Locomotive Works, Paterson, N. J., and builder of the locomotive "America", which took the first prize at the Paris Exhibition in 1867, was formerly superintendent of these Works. It may also be worthy of note that Zerah Colburn, Esq., the able editor of "Engineering", was for some time draughtsman at these works.

After upwards of 20 years experience, having built more than 420 locomotives in that time, this engine contains all the improvements which extensive use and constant study have brought forth. Throughout the whole machine, efficiency, strength, simplicity and accessibility of parts seem to have been constantly kept in mind by the builder. Nor are the comfort and convenience of the attendants neglected, as an inspection of the cab will show.

On comparison with the "America", the "21" shows much similarity, about equal weight and capacity, with some improvements in the boiler,—a result which Mr. Perrin and his employers may well be proud of.

From actual experience, I can say that the engine rides smoothly, steams excellently and burns fuel economically either on light or heavy work.

The mathematical equations in this thesis have been omitted.

The Birmingham and Derby Junction Railway

By G. W. Bishop

THE busy midland City of Birmingham, with its surrounding industrial district, so rich in coal and iron, soon attracted the attention of railway builders, and it is not surprising to find that several early routes converged upon the City. These, with the dates of opening, were as follows:

1. Grand Junction, 1837.
2. London & Birmingham, 1838.
3. Birmingham & Gloucester, 1840 (see Bulletin No. 10).
4. Birmingham & Derby Junction, 1842.
5. Shrewsbury & Birmingham, 1849.
6. Birmingham, Wolverhampton & Stour Valley, 1852, worked by L. & N. W R.
7. Birmingham & Oxford Junction, 1852, mixed gauge, worked by G. W. R.
8. Birmingham, Wolverhampton & Dudley, 1854, mixed gauge, worked by G. W. R.

There was also the Manchester & Birmingham, 1842, which never reached the latter City, but joined the Grand Junction at Crewe. Two short lines in London had "Birmingham" titles, on account of connecting with the London & Birmingham Ry. These were the Birmingham, Bristol & Thames Junction Ry., incorporated 1836, which became the West London and West London Extension lines, and the E. & W. India Docks & Birmingham Junction, incorporated 1846, which became the North London Ry.

Concerning the early history of the B. & D. Jc. Ry., Mr. D. S. Barrie states: "This line was promoted as a direct line to connect the Cities of Birmingham and Derby, 'with a branch to Hampton', but it is quite evident that the latter 'branch' was merely another name for a line which would link Derby with London through a junction with the London & Birmingham Ry. at Hampton, whence the alleged 'branch' ran to Whitacre Junction to connect with the Derby-Birmingham line. By forming an alternative route from Derby to London this 'branch' was an astute move on the part of the North Midland Railway to counter those of their rivals the Midland Counties, who by virtue of their Leicester-Rugby route had at that time a monopoly of traffic between London, Derby and the North Midlands, although in effect neither railway had been built.

"The Act of Incorporation of the Birmingham and Derby Junction Railway received the Royal Assent in 1836, but whereas construction of the Whitacre-Hampton branch was pushed ahead with all possible speed, construction of the Whitacre-Birmingham section was neglected, so that the real intentions of the promoters became immediately evident. The line between Derby and Hampton Junction, 38½ miles, was opened in August, 1839, eleven months after the completion of the London and Birmingham line. At this time the Whitacre-Birmingham line had not been built, and through traffic from Derby and points beyond to Birmingham was sent via Hampton.

Thus in 1839-40 the B. & D. Jc. Ry. held a monopoly not only of traffic between Derby and Birmingham, but between the same points and London, the rival Midland Counties Railway having been neatly outwitted. On July 1, 1840, however, the Midland Counties opened the Leicester-Rugby section of their line, and feverish competition ensued with the B. & D. Jc. Ry. for the through London traffic, rates and fares being cut to such an extent that through passengers were only paying a fourth of the proper fares as between Hampton and Derby or Rugby and Derby.

The Whitacre-Birmingham section of the B. & D. Jc. Ry., 10 miles, was opened in February, 1842, but on a different alignment to that originally planned. In the same year, proposals were made that the rival Midland Counties and B. & D. Jc. Rys. should amalgamate, but these were defeated. In 1844, however, saner counsels prevailed, and these two railways, and the North Midland Railway were amalgamated to form the Midland Railway. The subsequent history of the Whitacre and Hampton line is rather pathetic. The Midland Railway's main route to London, upon the formation of the amalgamated company, immediately became that of the former Midland Counties, via Leicester and Rugby, and the Whitacre and Hampton section became a mere local line, which so long ago as 1845 had only one passenger train in each direction daily.

"It is rather a strange feature of railway history that portions of each of the three former main routes from Derby to London have in turn fallen on evil days, thus:

1. Whitacre-Hampton was part of B. & D. Jc. Ry. only from 1839 to 1844.

2. Wigston-Rugby section of Midland Counties Ry. formed alternative main line, 1840 to 1844; sole main line, 1844 to 1858; local branch line 1858 to present day. In 1858 the Midland Ry. was opened from Leicester to Hitchin, whence running powers were obtained over the Great Northern; on the opening of the Hitchin line the Wigston-Rugby link became of secondary importance.

3. The Bedford-Hitchin line of the Midland Ry. formed part of the main London line from 1858 until the opening of the new line to St. Pancras. Since then the Hitchin line, like those at Hampton and Rugby, has been a local branch and of practically no importance. One set of rails was removed during the War.

I think the last point I have made is of particular interest to the railway historian—that in less than 100 years there have been four different main lines from Derby to London, and three of them are now of particularly no importance. The opening of the Great Central Railway as between Rugby and Leicester, with its express services, killed most of the Midland traffic between Leicester and Rugby."

To supplement this historical survey it may be added that probably the first "through coaches" were those worked from Hampton Junction to Curzon Street, Birmingham, in 1839. When the B. & D. Jc. Ry. reached Birmingham in 1842 the Lawley Street station of the Birmingham & Gloucester Ry. was used, but it appears that the two lines were on difference levels, and that coaches were transferred by a kind of lift or ele-

vator, thus giving a through service between Derby and Gloucester. For many years the sidings at the end of the Lawley Street viaduct were known as the "lift sidings" in consequence. In May, 1851, the two lines were extended to Curzon Street station, which was already used by the London & Birmingham and Grand Junction Rys., and thus became a joint station for four companies' lines. Both these stations are still in use for freight traffic, a large new station for passenger trains being opened at New Street in 1853, by the L. & N. W. and Midland Rys.

In 1843 Queen Victoria made a journey over the B. & D. Jc. route, in traveling from Windsor to Tamworth, via Watford, Rugby and Hampton.

The railway had 15 locomotives, of which 12 were of the 2-2-2 passenger type, driving wheels 60", cylinders 12x18, built in 1839 by 4 different makers, thus:

"Tame," "Blythe" and "Anker" by R. & W. Hawthorn.
"Barton," "Tamworth" and "Hampton" by Mather, Dixon & Co.
"Derby," "Birmingham" and "Burton" by C. Tayleur & Co.
"Derwent," "Dove" and "Trent" by Sharp, Roberts & Co.

There were also two 0-4-2 engines for freight, driving wheels 60", by Thompson & Cole, and another 6-wheeled engine, details unknown. All were eventually numbered in the Midland Ry. list.

The Hampton branch, converted to single line, was for long a local curiosity, with its solitary daily passenger train. This was discontinued in 1916, but a daily freight still runs. Part of the old Hampton station, can still be seen, near to the present L. M. S. station, also the locomotive depot, now used as a timber and corn mill. Two houses near the line were built for Mr. J. Allport, afterwards Sir James Allport, General Manager, M. R., and Mr. Matthew Kirtley, the locomotive superintendent, who afterwards held a similar appointment on the M. R. for 29 years.

There is one intermediate station on the branch, formerly called Coleshill, but on the cessation of passenger traffic it was renamed Maxstoke, and used only as a goods station. It still retains a stationmaster and signals, and is a curious English example in this respect. There is a tradition that on one day, when the passenger train ran, no less than seven tickets and a half were issued at this station, considered to be a record for such an isolated place! Near by is Maxstoke Priory, built by William de Clinton in 1337, also a castle which is still habitable.

Locomotive Pictures

THROUGH the kindness of some of the members of this Society, the nucleus of a collection of plates has been started and prints from these negatives will be furnished to those of our members who wish them.

Size 5x7

Neg.#				
907	Boston & Maine R.R.	"James Hayward"	4-4-0, Manchester	1866
1	Danbury & Norwalk R. R.	"Norwalk"	4-4-0, Rogers	?
2	Hartford & New Haven R. R.	"Mars"	4-4-0, Rhode Island	1869
3	"	"Taurus"	0-4-0, Hartford Shops	?
4	"	"Comet"	4-4-0, "	?
5	Housatonic R. R.	"N. Thayer"	4-4-0, Rogers	1867
6	"	"H. Nichols"	4-4-0, Rogers	1871
7	Narragansett Pier R. R.	"Narragansett"	4-4-0, Rhode Island	?
8	Newburgh, Dutchess & Ct. R. R.	#6	4-4-0, Brooks	1873
9	New Haven, Derby & Ansonia R. R.	"Morris Tyler"	4-4-0, Rogers	1876
10	New York, New Haven & Hartford R. R.	#196	4-4-0, Rhode Island	1883
11	"	"Wallingford"	4-4-0, Hartford Shops	?
12	"	"Berlin"	4-4-0, "	1877
13	"	#59	0-6-0, "	1887
41	"	#51	4-4-0, "	?
55	"	"Hartford"	4-4-0, "	?
14	"	#60	4-4-0, "	?

Size 8x10

138	Boston & MaineR.R.	# 1147	2-8-0, Schenectady	1901
139	"	900	4-4-2, "	1902
371	"	346	4-6-0, "	1904
395	"	973	4-4-2, "	1902
398	"	1163	2-8-0, "	1902
838	"		Arch at Walnut Hill, Mass	
863	"	1064	2-8-0, Schenectady	1905
866	"	682	2-6-0, Manchester	1906
881	"	21	4-4-0, "	1897
896	"	900	4-4-2, Schenectady	1902
955	"	822	4-4-2, "	1907
1118	"	837	4-4-2, Manchester	1908
1133	"	836	4-4-2, "	1908
2305	"	1293	Mallet Schenectady	1910
2478	"	5000	Electric Motor	
3708	"	1075	2-8-0, Taunton Rebuilt-Baldwin '98	1887
4893	"	3608	4-6-2, Schenectady	1911
6001	"	3663	4-6-2, "	1913
6004	"	3666	4-6-2, "	1913
6006	"	3666 & 601		
6647	"	3000	2-10-2, Schenectady	1920

6711	"	3653	4-6-2	"	1911
6764	"		Electric Motor on freight trn		
7074	"	3000	2-10-2, Schenectady		1920
7088	"	3006	2-10-2,	"	1920
7092	"	3006	2-10-2,	"	1920
7473	"	3701	4-6-2,	"	1923
7532	N Y N H & H	1359	4-6-2,	"	1916

The price for 5x7 prints to our members is 35c per print and to non-members is 40c per print. The price for 8x10 prints to members is 75c per print and for non-members it is $1.00 per print.

All orders for these prints should be addressed to our Vice President in Charge of Room—Mr. J. W. Merrill, 40 Broad St., Boston, Mass. Your check or M. O. payable to this Society should accompany your order.

Corrections in 1931 Membership List

In the 1931 list of members, copies of which were mailed to our members the first week in April are a few mistakes due to the printing which are corrected below:

E. Andre Schefer, 15 Rue des Binelles, Sevres (S et O), France
Leon H. A. Weaver, 60 East 42nd St., New York, N. Y.
F. Achard, 92 Ave. Mozart, Paris (16), France.
H. A. Laird, 732 Tribune Tower, Tribune Sq., Chicago, Ill.

and finally

H. R. Norman, 32A Upper Gloucester Pl., London, N. W. 1, England should not be listed among the deceased.

From latest accounts Mr. Norman is enjoying good health and the printer has promised not to bury any more of our members without our notification.

Pamphlets Wanted

One of our members, Mr. W. A. Lucas, 56 Tuxedo Ave., Hawthorne, N. J. is anxious to secure the following pamphlets:

American Locomotive Co. Pamphlets Nos. 10000, 10001, 10006, 10009, 10021-10031, 10036, 10039, 10041-10045, 10047, 10048 and 10050. Any number above 10051 and 11009.
Baldwin Records Nos. 2, 5, 8, 9, 33, 36, 38, 51, 52, 54, 56-60, 65 and 67.
Baldwin Locomotives Vol. 1. No. 2.

Mr. Lucas offers to our members the following:

American Locomotive Co. Pamphlets Nos. 10003, 10013, 10032 and 10049.
Baldwin Records Nos. 47 and 90.
Timken Roller Bearing Engine Pamphlet.

Mr. Lucas will appreciate any assistance that our members will give him to secure this material.

In Memory of

FRANK R. PETERS

60 East 42nd Street

New York, N. Y.

Who died on Feb. 19, 1931